This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

1817
ARTES
VERITAS
LIBRARY
UNIVERSITY OF MIC
TUEBOR

6448 2055

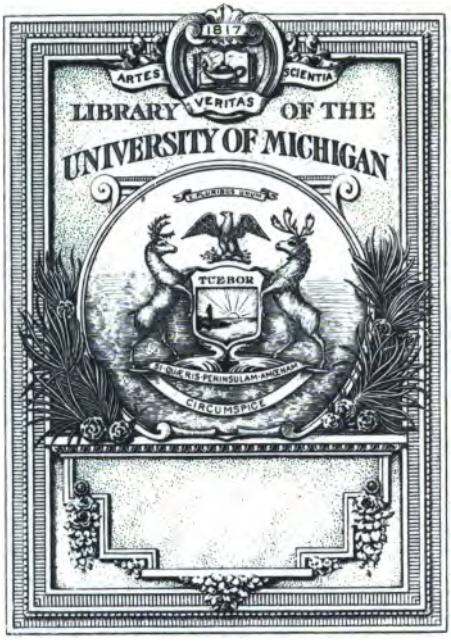
A 591779

Q
173
.B782

Bowsher

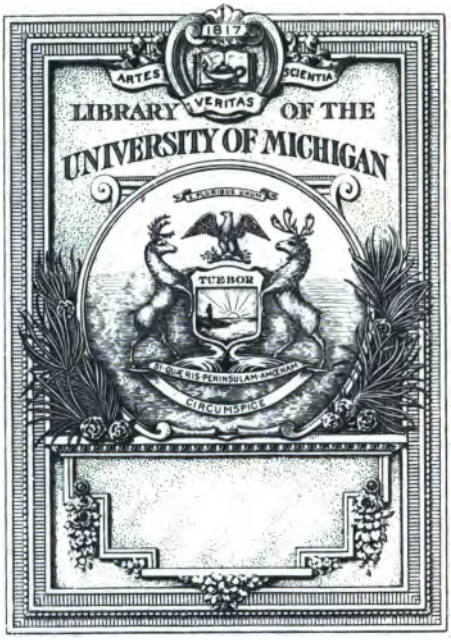
World relations.

Man and the cosmic principle...



THE GIFT OF
Prof. George A. Marley

Q
173
.B782



THE GIFT OF
Prof. George A. Marley

Q
173
.B782

WORLD RELATIONS

MAN AND THE COSMIC PRINCIPLE

BY

C. A. BOWSHER

CHAMPAIGN, ILL.
1899

Gift
Professor George A. Malloy
6-8-1937

To understand the world in truth, we must learn concerning energy.

Dedicated to

That appearing SOLIDARITY, that inspiring and progressive principle of the twentieth century, the mutual interest and welfare of all mankind, *the rightful manipulation of energy;* to its greatest advocate and protector, my beloved country, THE UNITED STATES OF AMERICA, and to that strongest guaranty for the perpetuity of them both, our noble SYSTEM OF PUBLIC SCHOOLS.

The need of some inspiring progressive principle for mankind to lay hold of for the satisfaction of that fundamental sentiment which aspires to a better condition is as strongly felt as it was in the days of Plato or Paul.

—WARD.

1899
COPYRIGHTED AND PUBLISHED
BY THE AUTHOR.

PRINTING AND BINDING BY
THE NEWS, CHAMPAIGN, ILL.

CONTENTS

"A SPIRIT'S TALE"..... Page 9

PREFACE..... Page 13

CHAPTER I—Introduction..... Page 17

CHAPTER II—A Psychological and a Pedagogical View..... Page 26

CHAPTER III—The Geographical Order of Notions..... Page 43

CHAPTER IV—Specific Geographical Relations..... Page 69

CHAPTER V—The Astronomical Order of Notions..... Page 93

CHAPTER VI—The Ethereal and the Molecular Orders of Notions..... Page 109

CHAPTER VII—The Biological Order of Notions..... Page 119

CHAPTER VIII—The Subjective Order of Notions..... Page 125

CHAPTER IX—Units and Limits..... Page 139

A SPIRIT'S TALE.

On the ecliptic plane, somewhere in space,
Two wandering spirits chanced to meet;
And, greetings befitting time and place
Having been exchanged, each found a seat
On a vacuum which jutted out
From the angle of an ancient void;
And one told the other all about
The scenes he had witnessed and enjoyed.

"I have traveled, I would have you know,"
Quoth the shade in a reminiscent mood;
"And have kept myself upon the go
In quest of the beautiful and good
For something over a million years,
Sampling the cream of the Milky Way
And in this and that among the spheres
Whiling the ethereal years away.

"I have searched Great Bear and Pleiades;
And oft, when coursing round for fun,
Have explored what stupid mortals please
To designate by the name of 'sun;'
Though solar systems, each spirit knows,
Are our Father's great magnetic fields
While suns are simply His dynamos
Each of which its share of glory yields.

"But the queerest sight that I have seen
Since death gave me a spiritual birth,
I discovered on a very green
And prolific planet called the 'earth'
By the mortals who infest it, sir;
(Though they say 'inhabit,' being vain);
And certainly God has blessed it, sir,
With everything mortals should obtain.

"With water, light, and atmosphere
Perfectly fitted for mortal breath;
Without a shadow of cause for fear
That when their spirits are freed by death
The Love that blessed them with life and light
May not well be trusted with the task
Of guiding their little souls aright,—
Dear brother, what more could mortals ask?

"With soil that repays a thousand fold;
With our Father's code of perfect laws
Vigintillions of centuries old,
Which mortals term 'effect and cause,'
With grass and flowers and leafy trees
And other factors of earthly bliss,
Such as cattle, sheep, fish, birds, and bees,
And sweet babes designed for mortals to kiss.

"Really, a spirit with sense would think
That mortals seldom enjoy themselves,
But make life a task from start to end,
For each of them digs and delves
In grime and dust and in heat and smoke
Of foundry or office, mill or shop,
From the moment a bell sounds a stroke
Until a whistle says they may stop.

"Their young are referred to bees and ants
To learn the lessons of life instead
Of bidding them take an humble glance
At God's perfect systems overhead.
The objects of mortal life it seems
Are either to win or buy or sell,
And to evade, at the end thereof,
A condition they summarize as 'hell.'

"For their conceits have such a bevel
That they believe, something strangely odd,
That everywhere a great strong devil
Opposes or runs a race with God.
At most two billions (doubtless fewer)
Many pine for room and light and air
Where forty billions could flourish sure
With abundant light and room to spare.

"Of their governments, the best of any
That came within my spiritual view
Looked like 'government by the many'
For the benefiting of the few,
But, to sum it up for what it's worth,
I will say that real spirit tears
Were drawn from my eyes while viewing earth
For the first time in a million years."

—*John Gladding.*

PREFACE.

This little book is an attempt to present fundamental world relations and their simple derivatives in such form that they may be conceived as an entirety in a system of coördinated principles.

It is a conviction of the author that errors prevail in the presentation of fundamental world relations to the mind. A certain perspective seems to be lacking in adapting many of the interpretations of nature to normal reason. It is believed that they are not presented in a proper system of coördination, not gauged with appropriate units of measurement and the point of view is injudiciously selected to present correctly relations existing between the mind and its physical environment. The author is persuaded on this account that if a stranger to our geographic knowledge were to pass judgment on our notions of world relations by a strict interpretation of descriptive terms and on many methods of presentation used in teaching today, he would be justified in making the inference that we believed somewhat in the Ptolemaic theory of world relations with the additional fact that the earth is flat.

We speak of the earth being spherical, having a rotation and a revolution about the sun, etc., etc., but many popular definitions descriptive of these rela-

tions and their simple derivatives imply that we do not wholly understand them. As learners in the fundamentals of geography and astronomy it is believed that we should "get off the earth" to properly conceive of these simple relations. Our notion of things from a physical basis depends upon the point of view and the unit of measurement which we employ to make our deductions. Heretofore the geographer and philosopher have measured world relations from the standpoint of the individual. Consequently the unit of measurement and the point of view have been erroneously taken and deductions made by them are proving too small for present day requirements. Today, notions of world relations are becoming generalized by the use of enlarged measuring units in terms so grand that to appreciate our relative position and condition in the progress of the human race, a proper conception of these fundamentals should be realized.

Any simple treatment of fundamental world relations, however, must necessarily work along the frontier of extreme generalizations and they must be so presented that the fundamentals and their derivatives may be distinguished. The starting point for this exercise of the mind has its ideal place in the fundamentals of geography and astronomy. The subject matter therein contained may be considered the kindergarten principles of all sciences. The time and place to begin the study of them are in the grade schools. Chapters III and IV present what the author considers the fundamentals of geography and astronomy

presented from a specific physical point of view, that is, "off the earth." The remaining chapters are considered as a presentation of the simplest derivatives of objective reality accompanying these fundamentals and are consequently proper subjects for mature minds. The consideration of these derivatives in the fullest sense of the word is obviously a contemplation of all possible world relations. Such, however, is not the purpose of this effort. The cosmic principle herein discussed is considered the physical law from which all subjective derivatives emanate. It in turn is a derivative from the principle of universal gravitation as propounded by Le Sage over one hundred years ago.

The author makes claims for originality only in the treatment of derivatives from this basic theory of Le Sage. He also makes acknowledgements to the great spirit of Clerk Maxwell which now so brightly illumines the psychologic world and whose interpretations in fundamental principles shine forth as suns in the galaxy of universal knowledge.

If what is written proves helpful to the reader in gaining a more comprehensive view of his world relations, the desires of the writer will not have been in vain. And if views presented appear at variance with him and doctrines apparently well established, the writer begs but the privilege to submit the differences of opinions to the great democracy of ideas where truth is judge. Very respectfully,

C. A. BOWSHER.

Champaign, Illinois, 1899.

WORLD RELATIONS:

MAN AND THE COSMIC PRINCIPLE.

CHAPTER I.

INTRODUCTION.

What is the world? A term which men have got
To signify not one in ten knows what.
A term which with no more precision passes
To point out herds of men than herds of asses.
In common use no more it means, we find,
Than many fools in same opinion joined.

—*Churchill.*

Different minds have different views of the world. Man has ever striven to gain the concept of it that will receive the sanction of his fellows. The history of philosophy records the dissimilar views of representative thinkers in their efforts at solving the problem. Parmenides, Aristotle and Bacon, Socrates, Descartes and Kant have each contributed his mite and yet only parts of the general idea have been described.

Man today has a good insight to the historic world but he has no better idea of the present upon which all may agree than had the ancestors of their times. Man's conception of the world must ever re-

main in relative terms. The past may be conceived, the present may be dreamed but the future can not be known. Progress in civilization means a change of man's relations to the cosmic principle. As he interprets his relations to this controlling genius of the human race, so will he conceive of the world in truth.

From objective relations man may gain certain absolute conceptions. Hence there are concepts which all mankind may perceive as true and which will ever remain in similar terms and relations to the mind. However, the whole truth is of an infinite conception and however much one may interpret from the factors of objective reality, his deductions with those of his predecessors can be but relative to the amount his successors may attain. That is, as man progresses he will change his views of the world within certain limitations on account of the quantity and quality of his interpretations of nature.

Since the subjective relations are derivatives of a high order compared to the objective relations of man, it is plain that the latter will furnish him with a better scheme by which he may build a rational and consistent view of the world. The factors of objective reality will ever remain in persistent relations and so true as the earth preserves its dimensions and relations in the solar system, so will man be able to establish a consistent view of them. Consequently the efforts of man in his interpretations of objective reality may be continually augmented by his successors. However, some first mind must make such an initiative in the interpretations that his successors may in-

telligently attach their deductions to the same general plan in making the great inquiry. A general scheme must be formulated and certain plans and specifications be adhered to, that future inquirers will not presume it necessary to alter them in order to satisfy their interpretations. The higher criticisms to which it will be subjected in after years will not cause it then to suffer disparagement. Such a scheme is now supposed to be in the minds of men. Bacon furnished rudiments of the first systematic scheme, it is believed, when he said "that man, the minister and interpreter of nature, does and understands so much as he may have discovered concerning the order of it by observing or meditating on facts." Sir Francis was the first man to discover and formulate the fundamental truth that all interpretations of nature should be founded on a basis of well known facts. Since his time the world has seen real progress in civilization.

When the civilization of the ancients is considered, in their wondrous development in the subjective relations, "in the science of government, the beauty and grace of their literature, the subtleties and refinements of their philosophies and the genius and nobility of their architecture," it might seem strange that the conception of this only method for the interpretation of nature should remain for their barbarous successors to proclaim. Such, however, is the case. It is the way of progress. Without an Aristotle and an Euclid no Bacon and Newton could have arisen. Without the subjective efforts of the ancients the mind of succeeding ages could not have attained that acumen

necessary to determine a fact. All subjective and objective prophets of the world, from Moses to Clerk Maxwell, have contributed to formulating the grand interpretation. And though this and succeeding ages may differ with them somewhat in the interpretation of objective reality, the subjective relations have been accurately outlined and so perfectly has this been done that the present finds itself as incapable of fulfilling the rightful law as it is in attaining a satisfactory concept of the objective world. The progress of the human race in satisfying these subjective relations and requirements proclaimed nineteen hundred years ago, will depend in most part on its conception of the great cosmic principle and in understanding man's relations to it and objective reality.

The cause that actuates man, that propelling genius which furnishes him with a motive, which compels him to do and has and ever will furnish him with the impulse to progress in the world, is the central factor of all subjective reality. Man, the highest derivative of the objective world, is an index to its potency. The cosmic principle—the function of every organism is to dissipate and manipulate energy—is the great central factor which one must perceive should he conceive of a rational and a consistent view of the subjective and objective world.

To have the capacity to do this might argue to some that the mind of future man must become stronger than the mind of the average of this day to obtain the proper interpretations. And since we progress, many will contend that the mind of the present age is

stronger than that of the past. To sustain this general belief it is cited that problems are solved and conceptions are attained which lay beyond the powers of the ancients to apprehend; that grand truths are taken as a matter of fact by the ordinary school boy which were impossible for them to imagine, and further that the progress of civilization is a direct index of the superiority of the mind of the present age. Such, however, is not the case. The perfected mind of today is not in advance in acquired faculties, propensities and strength of the perfected mind of two thousand years ago. There are limitations to the developments of the mind and the limits are set by the factors of objective reality. The mind is a derivative and its attainments are necessarily limited by the central fact of all subjective relations, the cosmic principle, the dissipation and the manipulation of energy.

The race comprehending this principle and capable of adjusting itself to it may be said to be civilized. This age more nearly realizes or perceives, rather, the meaning of this principle than any other in the annals of history and is therefore popularly termed stronger. The normal mind is not stronger, however, but more powerful. It is situated as it were upon an eminence of accumulated information concerning the world relations pertaining to the cosmic principle. This intellectual age has surmounted the obstacles of the past, not by seeing through them but by looking over them. The mental horizon is extended, but the fundamental world relations and common experiences are no more intricate and hard to under-

stand than were those of ancient days. An accumulation of recorded experiences relating to the successes and failures of man in his struggle with the cosmic principle serves him should he choose to profit thereby. Successes may be repeated and augmented and failures may be lessened or eliminated by noting the experiences of predecessors. These experiences relate to the general mind rather than to the individual. Hence by profiting by the experiences of his ancestors in contending with the cosmic principle, renders man more powerful to contend with its requirements. The library, the museum, and the fair are the best examples of these accumulated experiences whereby society is enabled to take advantage of them.

No one can claim that Clerk Maxwell was superior in strength of mind to Euclid; that Aristotle was less a logician than Sir William Hamilton; that Socrates and Plato were more simple minded than Bacon and Descartes and Kant; that Webster could stir the hearts of men more deeply than Cicero, or Gladstone become more fervent than Demosthenes; that the hero of Austerlitz commanded the hosts or the ship of state in better form than he who gained Pharsalia and thrice refused a crown; or that any bishop of the present greatest renown is more highly endowed than he who from the heights of Mount Sinai interpreted the "oracles of God."

Another point against the general opinion may be cited. In this accumulation of recorded experiences, man has been enabled to classify them. He has separated them into the eternal and transient, the

absolute and relative, the objective and subjective relations. Aristotle was the most famous in beginning the art of proper interpretation and classification of these world relations. Bacon first systemized the process and this era is engaged in perfecting the scheme. The distinction between objective and subjective reality can be perceived by supposing man stricken from the face of the earth and then conceiving those world relations yet remaining. It is obvious that were man stricken from the earth the winds would yet blow, carrying with them the summer's showers and the winter's snows; the storm would still rage, devastating the plain, or surge in mountain waves the surface of the deep. Would the avalanche then cling to the mountain's side or Niagara's flood cease to roar? Would the birds still sing and the seasons cease to wax and wane? Would the earth cease to turn or make its annual tour, and all earthly nature fail to break in gladness under the kisses of the sun? No, the world relations eternal would still exist in their harmonies. Replace man and what additional world relations will accrue? Everything pertaining to humanity, the fleeting, transient, relative and subjective: those relations which man will see fit to change in order that he may more fully obey the mandates of the great cosmic principle in so far as he is able to understand them. The relations of the home, the profession, the church, the school and the state and their infinite number of interrelationships will change to suit the convenience of man.

Man being so small and transient, many subjective truths are taken by him as eternal on account of the magnitude of the time element necessary to work a change in these relative world relations. And contemplating the series of recorded experiences of different races and generalizing their controlling impulses and motives, enables man to distinguish the more fundamental and essential subjective relations from the more highly derived and the more transient. Relations concerning religion, politics, profession and home will change. Yet there are factors in each which yield so slowly in the shifting process of the progress of civilization that he, in too many cases, considers them as absolute and eternal. Hence the mind of this age being enabled to distinguish these properties of man's relations to the world, renders it more powerful than similar minds of the historic past, but no stronger. And it stands to reason that if an interchange could be made between us and the worthy ancients mentioned above, that world relations today would be none the less ably determined, conceived and obeyed.

As an additional point to the contrary in the general argument, the present age is now completing the discovery of that form of thought which Euclid, Aristotle and Plato partially made. This discovery is the most potent acquisition to the powers of the mind for the interpretation of the world relations existing between the factors of objective reality that the annals of human history record. The mathematical form of thought expresses all relations exist-

ing between these factors and it is employed by all minds of whatever race capable of manipulating relations referring to the cosmic principle. In fact the great cosmic principle can not be interpreted by any other form of thought. It is a mathematical concept in itself. All progressive races are consequently mathematical in their propensities. The common conception of these peoples are that they are practical. That they are a busy and prosperous people at once raises any race in the estimation of men. It simply means that they are dissipating energy systematically. Color or previous condition of servitude is a secondary matter in the great democracy of mankind, if the bearers of it are among the best manipulators of energy.

A resume of the contrasts of the present state of the mind with that of the past is that it is superior and more powerful but not stronger; that the experiences with the world relations are being more perfectly recorded, classified and interpreted as time rolls by and that the mind is more thoroughly equipped with information and right principles which will enable it to comply more nearly with the dictates of the cosmic principle.

Thus the mind may form a conception from an absolute basis concerning its world relations and the meaning of progress of civilization and be furnished thereby with a scheme for their positive considerations.

CHAPTER II.

A PSYCHOLOGICAL AND A PEDAGOGICAL VIEW.

In dealing with world relations, the mind is compelled to operate with a range of infinities. The concept of an infinity or an infinitesimal relation of course can not be realized, but the different orders of infinite relations can be compared with one another such that the deduction will appear to the mind as a comparatively simple idea. For instance, a drop of water is to be compared to the earth in size. The comparison of course can not be conceived. But suppose the mind should wish to conceive of the relations that a molecule might bear to a drop of water. Sir William Thomson says that if a drop of water be magnified to the size of the earth, that its molecules would appear about the size of cricket balls. Thus the mind may have a basis for a contrast of two orders of infinities. Again, suppose the particle of ether to hold a similar relation to a molecule that the earth bears to the solar system, then a third order of infinities may be apprehended. Again the earth may bear an infinitesimal relation to the solar system, and the solar system bears an infinitesimal relation to the visible universe, then by similar comparison another idea in infinite relations will be furnished to the mind. Again, let us take the temperatures which certain heated masses may possess. The highest temperatures yet obtained by artificial means is 3,500 centigrade. Steel vaporizes at 1,900 degrees, water at 100, alcohol at 70, liquid air at —190. Water freezes at

0, mercury at —40, and alcohol at —125. By these relations boiling water is hot compared to freezing water and freezing water is very hot compared to freezing or solid atmosphere. The question of manipulating energy from the sun, the great industrial inquiry which the twentieth century will pursue, will consist in adjusting the mind to proper conceptions of heat relations existing between the different states of matter. To be able to manipulate energy from the sun without the intervention of plant life means nothing more than being able to interpret relations existing between the different states of matter in the scale of temperatures.

In the organisms of gross life, from cell to man, the mind conceives of a series of infinite relations one to the other. The host of one becomes the parasite or part of the next higher order. The welfare of man in respect to organic diseases depends upon the mind adjusting itself to magnitudes where the body of man is a world for the colonies of germs which it contains. The governments of men and the federation of the world are of infinite relations to the ward, precinct, etc., and trusts and colossal combinations of trade are but higher forms of the little shop at the cross roads. Thus these few examples illustrative of relations existing between the factors of objective realty show that a proper view of the world will compel the mind to adjust itself to a range of infinitesimal and infinite relations. From the ethereal particle to the extent of the visible universe, the range of infinite relations may be conceived by noting a series

of units and limits, viz., the ether particle, the molecule, the cell, the man, the earth, the solar system and the visible universe.

By conceiving all objective reality as a series of interdependent infinite relations, man's interpretations of phenomena may be classified into different orders of notions, bearing such relations to one another that any order may be considered of infinite relations of major or minor dimensions to those preceding or following respectively. The interpretations may be classified into the ethereal, the molecular, the biological, the subjective, the geographic and the astronomical orders of notions.

The ethereal order of notions includes those interpretations of phenomena that are classed under the general subject of physics.

The molecular order includes those interpretations classed under the general subject of chemistry.

The biological order includes those interpretations relating to the general subject of organic life.

The subjective order of notions includes those interpretations relating to the activities of man and his relations as a factor in objective reality. The home, the church, the school, the state and the vocation are the divisions of the order and their inter-relationships are supposed to be considered under the head of sociology.

The geographic order includes those interpretations relating to the earth as a moving, living object engaging and dissipating energy from the sun. The subjects of geology and physiography belong to this order.

The astronomical order includes those interpretations of nature extraneous to the earth.

By the consideration of these orders of notions the mind is furnished with a system of coördination for a rational arrangement of interpretations of nature as a series of infinite or infinitesimal relations. The mind is also furnished with a unit of measurement in the different orders by which phenomena may be properly considered. The names of the units are implied in the orders of notions and are known as the particle of ether, the molecule, the cell, the man, the earth and the solar system. Each unit may be considered as a limit in dimensions to the one in the next lower order. That is, the molecule limits the ether particle in its individuality in the formation of gross matter and its considerations. The cell is a limit to the molecule in its individuality in the considerations of organic life. The man limits the cell in its application to biology. The earth is a limitation to the man. The solar system is the limit to the earth. And the visible universe is a limit to the solar system which is used as a unit of measurement to it. The formula for representing all world relations in this system of coördination as an entirety can be represented as follows:—

$$\frac{A}{\infty^4} + \frac{A}{\infty^3} + \frac{A}{\infty^2} + \frac{A}{\infty} + A + A\,\infty + A\,\infty^2 = \text{all world relations.}$$

The universal psychological law for a perfect agreement of all minds in their interpretations of phenomena is that *they shall use the same language, employ the same terminology, have the same units of*

measurement for contrasting conceptions, have the same system of co-ordination for arranging deductions and have the same point of view. The subjective order was the base of deductions 2,500 years ago. "Know thyself" was the password into the grand temple of Minerva. *Know the world and find thyself* is the modern dictum for entrance into the shrine.

The mind in general has shifted itself in its point of view in considering world relations. It has experienced something like a "precession of equinoxes" in its world views. The ancient Hebrews considered the earth a disc resting upon pillars of solid foundations. Over and above the earth and resting on these eternal foundations arched the solid dome of the sky or firmament and in which the stars were set for the use of men. The center of the earth was Jerusalem. Surrounding the earth was the ocean or sea, the edges of whose waters were upheld by the clouds. Above the firmament were the heavens where dwelt God and the angels. The heavens at the command of God would open or divide, by which means the angels were permitted to minister unto mankind, and the prophets were enabled, by ascending the mountains, to see God face to face and to interpret the oracles. The Greeks had a similar conception of the general world but immensely more complex in detail. To the nether regions were consigned the souls of men. To the Elysium fields were sent the good and brave while the bad were condemned to Tartarus for punishment. Every prominent world relation was represented by some god or goddess. The

underworld was ruled by Pluto, Neptune governed the sea and Jupiter or Zeus commanded the ethereal realm. On Mount Olympus' top convened the senate of the skies from time to time to regulate the affairs of mortal man. Over all gods and goddesses there existed an unknown God for whom no attribute could be assigned. This God of the Greeks, the Creator of the universe, was the God of the Hebrews and whom the sons of men worship unto this day. Thus it is believed that from a psychological standpoint the ancients measured the earth by the dimensions of man. It is not strange, therefore, that it would be considered flat, having corners, and that all considerations of the world were influenced by local prejudices. They considered the world relations in a lower order of notions, the subjective, and consequently, compared with what is known today, the mind of the race may look back on the mind of 2,500 years ago in similar relations as a balloonist may differently view a landscape.

Since geography and geometry have well defined limitations in the interpretations of nature, the mind of this day is equipped with those deductions from absolute relations and that instrument of thought, such that it assumes as common sense what in most cases lay beyond the ken of the ancients. The advantage lies not only in having better instruments for thought and a greater accumulation of experiences but in addition having a different measuring unit for making basic conceptions and having a different point of view. The base of deductions for a

proper measure of world relations lies in the geographic order of notions. This order also locates the proper point of view. The symbol for this order of notions is A.

The geographic order of notions is quite comprehensive. Its realm includes much of the other orders and is distinguished only at its gross deductions. Its deductions may be considered the most general form of serviceable knowledge for progressive and practical peoples. It treats of the general environment of the individual and acquaints him with the practical affairs of the world. No individual can become learned or cultivated without having broad and extended views and no one can lay claim to these elements of superiority without having the instruments of thought and power of mind to interpret the fundamentals of the geographic order. As with the individual so with his people. No race can become great, superior and lasting without at least the knowledge of geography and mathematics. These two are the most fundamental studies of social progress. By mutual induction they have exalted one another to their present grand proportions. The one is the study of one of God's beautiful pieces of handiwork and the other contains the form of thought necessary to interpret the relations existing between the factors of objective reality.

Nations claiming superiority in that which betters the condition of mankind not only possess great portions of the earth's surface but also claim the greatest knowledge concerning it. And, too, they

most nearly obey the fundamental laws which enjoin them to it. Many international contentions would come to naught were the respective peoples well instructed in their world relations. It may not be far wrong to say that most troubles between peoples signify that those parts of the human race are teaching and learning some geography lessons. Once powerful but decaying nations are indications that geographic relations have been forgot or are not understood. And, besides, they may lack the form of thought and language necessary to translate the absolute relations. The knowledge and use of geography and mathematics are the glory and intellectual strength of England, United States and Germany and the lack of them both is in great part the cause of inferiority of all nations possessing undeveloped resources. Oriental countries are instances in this respect. Having common sense could be defined as having geographical knowledge, and a superior race could be termed a great collection of people possessing a great amount of it. These latter expressions are but derivatives concerning man's relations to the cosmic principle.

The geographic order being of broad proportions as a branch of study, there might be some question as to its beginning and end. The end when attained will contain those deductions concerning the relations of the earth, however many sciences they may be classed into. The beginning will compel one to consider the gross positions and movements of the earth which would be found were it possible to step aside and view it as an automatic, multi-moving spherical

object. In beginning to study the geographic order of notions, we are liable to begin with a wrong ratio in establishing concepts of the absolute relations. Our view of things of whatever order of notions is determined by a certain basis of comparison. If the unit of measurement with which we begin be taken too small, the ratio after a certain limit has been reached in our interpretations passes beyond the power of apprehension. This has been the general fault in the beginning of the study of the geographic order of notions. Man heretofore has been made the central factor around which everything is made to rotate and revolve. The unit of measurement being taken and thus established, all definitions and descriptions were made to fit. The sun then "rises" and "sets." It goes "north" and "south" in its yearly motions. The earth's surface is separated into sections and the distorting projections are arranged in folios for study. Then commences teaching and study that the earth is flat. Although we should arise and resent with much emphasis to the contrary, a strict psychologist would assert that much of our present teaching in the fundamentals of geography and astronomy cannot be otherwise. We say in words and read in printer's ink that the earth is round like a ball, but we portray the form in drawings which one can but perceive as flat surfaces. Were one to begin the study of the ox with a drawing of the hide stretched over a flat surface, having coloring to taste and scale to suit, and to continue to apply himself to this exterior for ninety-five per cent. of the time set aside for the study of kine, no

doubt when the real live ox would present itself to view, his bellowing majesty would hardly be perceived either in form or movement. As far fetched as this may seem for illustration, the geographical psychologist will not hesitate to apply it. Many pupils of our dense cities would gain about the same knowledge of the ox as too many pupils in the public schools now conceive correctly of the simple fundamentals of geography.

How long these misconceptions of the measuring unit and the basis of comparison continue with the grown up and graduated would possibly excite too much criticism here to say. To realize it, however, consider how clumsily many of the well informed of the community thought concerning the great battle at Manila. The United States was conceived as located on a certain page in a book. Spain was located on another map near its lower left corner and the Philippines near Asia on the right margin of a third. Or, probably, the conceptions were from the too well remembered only hemispheres of the earth hanging on the wall and joined at their waistbands by some invisible hinge. The effect of studying a flat map is to put the mind of the learner on a flat surface. The associations and relations constantly appeal to the mind as such and unconsciously and ever at it, it arranges the information to suit the environment. The learner is made the center of consideration and is kept in imagination on the earth, whereas he should conceive himself away from the earth, considering it and its relations as an automatic moving

object. Therefore to attain the right basis for the study of the earth's movements and the relations of the parts of its surface, the learner must always be considered away from the earth. This can not be done while viewing a flat surface. It can be done only by considering a properly mounted globe.

Beginners should not be taught from flat maps. The error can be expressed only by saying that the better one conceives of the earth's surface from planes the more should he be convinced that the earth is not round. A plane map may be studied with profit after the sense of the earth's rotundity has been established, having the continents and general configurations conceived in terms of spherical latitude and longitude. The great desire should be that the mind be presented to the proper form of the measuring unit of the geographic order when beginning the study of geography. Most forms of subjective knowledge find their cause of being in the fundamentals of the geographic order, and the moving, living earth should be taken as the basis from which all geographic information is developed.

Much that is wrong in the presentation of the geographic unit comes from a wrong conception of the sun. And this misconception is in most part on account of the mind not having the right basis and standpoint for making its deductions. The smallness of the eye necessarily gives a small image of the sun, the size being appreciated only by the divergence of the visual angle. Astronomers consider the sun as a point of light, practically speaking, and

having made forms of calculations and definitions to suit their specific purposes, early geographers adopted them for use and developed notions from them which, in the light of present knowledge, should not be conceived. The sun being treated as a small affair, by inference, from use of astronomical terms, it travels from north to south in its yearly motion and from east to west in its daily motion, as the easiest concepts for these relations. And today at our stage of enlightenment so-called, the number of people who conceive of the real cause of the sun's apparent motion from east to west can be numbered. And as to the apparent north and south movements of the sun, but few have right conceptions of the real cause. This latter statement is especially inclusive of those encouraging the young ideas to "shoot" in the geographic order of notions. As an apology for the statement, it can be truthfully said that the teacher is not responsible for the present status of affairs in the teaching of the fundamentals of geography. The fault lies with the early geographers who have given wrong interpretations to the absolute relations of the geographic order. They have selected the wrong measuring unit for making their comparisons and have selected a wrong point of view. Most instructors today use the terms of the pole tipping towards or away from the sun or the sun going north and south of the equator. Trying to preceive these statements will forever stand in the way of the learner in conceiving of the true relations between the earth and the sun in respect to heat and

light and the phenomena arising from the combinations of these relations with the two gross motions of the earth.

Placing the earth in corsage, in the classical, vividly colored heat zones of permanence, is a direct growth from these early astronomical terms applied to terrestrial affairs. The so-called ecliptic circle, now printed on all terrestrial spheres, shows plainly the misinterpretation of terms by early geographers and which is now tacitly admitted as representing true relations by continuing its use. The placing of this circle, or rather its position on a terrestrial globe, points out the parties responsible for the mistake. It is evident that Gallia can not be blamed, nor Espania, nor Russia, nor Cathay, nor the United States, for its peculiar location. The fact is that Britannia must stand the charge, because the intersection of the ecliptic circle with the equator is made on the meridian of Greenwich. France would have had the intersection on the meridian of Paris, Russia on that of St. Petersburg or Moscow, Germany on that of Berlin, and the United States would have made the intersection on the meridian of Washington. In fact every meridian on the face of the earth can claim this worthy distinction and be equally just. The location of any one of them argues for the location of any number of millions more. The case can be cleared by stating that the circle is not a terrestrial affair at all and has no place for representation on a terrestrial globe. The term is related to an astronomical affair and must be considered in that order of notions. It

describes not at all the path of the direct ray of the sun on the earth's surface during a revolution. The rotation of the earth will not permit of the representation. Thus questions which puzzle many a teacher on this topic can be answered similarly to the query as to snakes in Erin,—there are no questions on a terrestrial ecliptic.

These misconceptions of the pole tipping, the sun going north and south, the belting of the earth with climatic zones of permanence and the ecliptic circle, have been introduced by geographers fitting astronomic terms to apparent geographic facts. These errors, combined with our present method of producing such vivid conceptions that the earth is flat, make the study of the fundamentals of the geographic order one of the most indeterminate branches of the school curriculum. This is the testimony of too many of our teachers in the public schools.

The most common errors in teaching this subject are made:—

By presenting wrong conceptions of the sun's relations to the earth. That is, of the comparatively magnificent dimensions of the sun and its distance from the earth.

By presenting the earth's surface in unrelated sections on plane maps.

By not having the learner to conceive himself away from the earth and considering it as an automatic, perpetually, multimoving, spherical object.

By presenting the earth's positions and motions and their complex interrelations by the lingual method

for imparting the information. By presenting a projection in spherical geometry for the learner to translate when it commands more acumen to translate the drawing than to understand the fact which the projection illustrates.

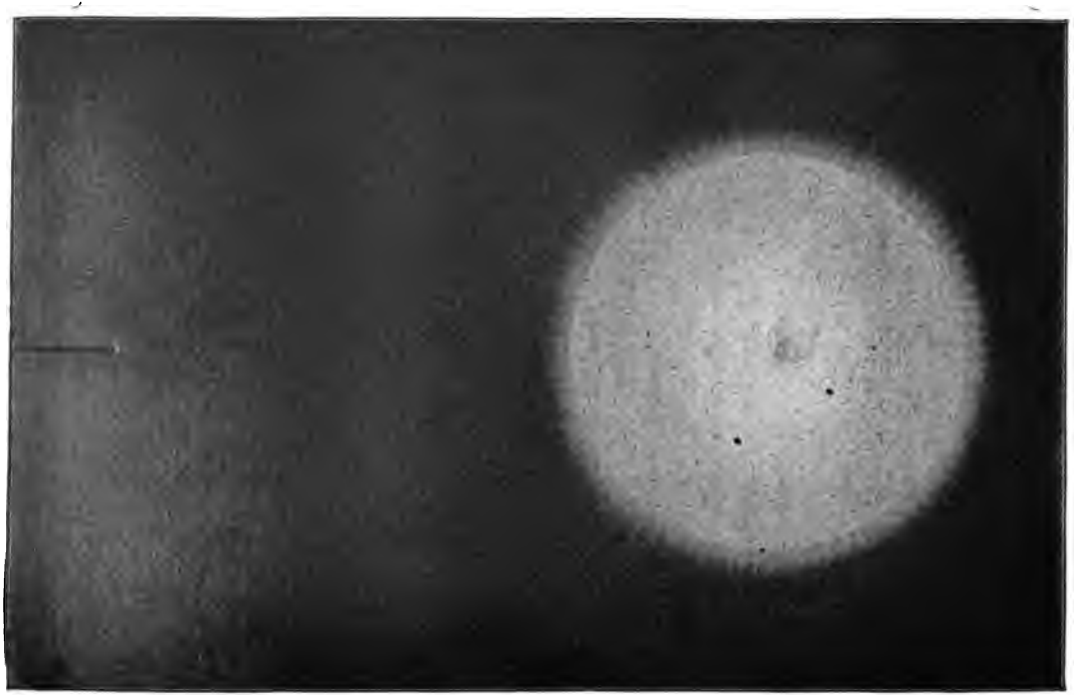
By presenting but one factor of the grand measuring unit of the geographic order at a time when the entirety should be presented simultaneously. The factors of the geographic unit are the shadow of the earth, the insolation, the rotation, the revolution, the inclined axis and the permanence of the parallelism of the axis to a given straight line. These factors are phenomena for the sense of sight and not of hearing. Hence, failure to present them from a linguistical standpoint, is quite sure to be attained. With these impedimenta, the teacher and pupil in too many cases have sorrowful times with what ought to be one of the most lovely and fundamental of the school studies.

Some argue that the high school is the place to learn these fundamental geographic relations and that it is beyond the ken of grade pupils to attain conceptions of these absolute relations. Such has been the case, sad to say, and to go further with the argument too many are completing our high schools and colleges, without being apprised of their errors. The trouble does not lie with the capacity of the grade pupil but with the first principles. These fundamentals can be attained in the fifth, sixth and seventh grades perfectly and positively if the real relations be exhibited to the eye. Otherwise, the most highly endowed in

christendom can not understand the fundamental relations of the geographic order of notions.

It is a sad commentary on our teaching to have instructors in astronomy bemoan the fact that the fundamentals of the geographic order have been so thoroughly and badly taught. They affirm that many times would they prefer to begin with a mind blank on this subject than to attempt to teach one well grounded in these world relations as presented in too many schools and colleges today. The gray matter after years of linguistical agitations may be set to peculiar forms. The patience and persistence of the most enduring sometimes fail to reorganize these structures. The setting had an eternal purpose and the delight of any teacher is to know that a fact has had its final cerebric repose.

Since our sense of sight is responsible for the great majority of conceptions, any fundamental error in sight relations in the geographic fundamental factors will lead the learner from the truth. And the greatest fault in conceiving properly of the geographic relations comes from misconceptions of our relations to the sun.



The earth represented in this figure is three times too large and ninety times too close.

CHAPTER III.

THE GEOGRAPHICAL ORDER OF NOTIONS.

O! How beautiful to see this earth
Poised in the celestial deep, with all its seas,
Mountains and plains, majestically rolling
Around its noiseless axis day by day,
And year by year, and century by century;
And as it turns, still wheeling through the immense
Of ether circling the resplendent sun
In calm and simple grandeur.—*Atherstone.*

SYMBOL A.

Unit, the earth. Limit, the solar system.

The fundamental concepts of the geographic order of notions are position, direction and gross motion. From the inter-relationships of these fundamentals all possible notions of phenomena of the geographic order are derived. The most elementary concept will be a position from which all other notions may be considered. It furnishes a starting point or a basis for a rational development of a general view of the world. Since the extreme dimensions of the geographic order are the simplest terms of the astronomic order, the primary notions considered in this chapter will partake of the realms of each. Such will be the case in considering the positions, directions and gross motions.

Man is finite. The universe is infinite. However great man may conceive of any dimension, his greatest conception, by comparison, can be but a finite part of the similar infinite dimension. In more condensed form, the infinite of the finite notion is but a finite part of the similar infinite notion. Conse-

quently to finite man, the center of the universe may be anywhere. Let a plane intersect the universe such that it will pass through the centers of the earth and sun at any time of the year. This plane will be called the plane of the ecliptic. It cuts the universe into two parts, one of which will contain the north star and the other the southern cross. The north star side of the universe may be termed its positive half, and the southern cross side, its negative side or half. The observer in the geographic order of notions may conceive himself on the plane of the ecliptic on its north star side watching the earth rotating and revolving, measuring out time. The choice position of the observer seems to be southeast of the sun. From the sun towards the north star nearly, on the plane of the ecliptic, may be termed celestial north, and in the opposite direction, celestial south. At the right hand is celestial east and in the opposite direction, celestial west. While here the observer will notice the small earth revolving noiselessly from right to front, then to the left around the sun. He also notices the inclination of the rotation to the plane of the ecliptic and that the positive hemisphere has its higher latitudes come nearer to the ecliptic plane on the celestial north side of the earth and carried further away from the ecliptic on the celestial south side of the earth during each rotation. He also notices that the shadow moves around on the earth's surface during each revolution and that it is the shadow moving over and away from the poles instead of the poles tipping toward and away from

the sun. Also that the rotation of the earth as well as the revolution has something to do with making differences in heating effect of the sun's rays on the earth's surface during the different seasons. When the earth is on the south side of the orbit, Fig. I, the rotation carries the positive latitudes closer to the plane of the ecliptic where the earth's surface for those latitudes slants less to the sun's rays at midday than it had slanted a few months before or will slant a few months afterward. He also notices that the celestial south side of the earth is towards the sun when the earth is on the north side of the orbit and that the rotation carries the upper latitudes further from the ecliptic plane on the then insolated south side, hence in this time of the year these latitudes slant more to the sun rays at midday than the same latitudes did to similar rays on the celestial north side of the earth. Hence the observer sees that the earth's surface slants to the sun's rays and not the sun's rays to the earth's surface. And also he sees that portions of the earth's surface turn to the sun and away from it rather than the fact that the sun rises and sets to them.

The vernal equinoctial point will always be seen at the right and the autumnal equinoctial point at the left. The summer solstitial point will be seen to be nearly under the north star or in the celestial north, and the winter solstitial point in the celestial south during all times of the year. Hence the tropic of Cancer is always touching the plane of the ecliptic on the celestial north side of the earth and the tropic of

Capricorn, always on the celestial south side of the earth. The equator crosses the plane of the ecliptic on the celestial east side of the earth and back again on the celestial west side.

Let us imagine ourselves on the plane of the ecliptic southeast of the sun for the purpose of getting the absolute relations between the members of the solar system and the remainder of the visible universe. The sun is in the center of our universe. The pole of the ecliptic is right over the sun. The vernal equinoctial point is east of the sun. The autumnal equinoctial point is west of the sun. The low part of the celestial equator is north of the sun. With these few "land"-marks we can make an adjustment of the universe such that a normal mind can get positive relations easily and be able to recognize them at any time of the year without confusion. First the planets will be located.

Neptune at this present writing is in the celestial north. Jupiter, Saturn and Uranus are southwest of the sun. Mars is nearly southwest of the sun, August, 1899. Neptune and Uranus can not be seen with the unaided eye. The north star is between the pole of the ecliptic and the north solstitial point nearly. Astronomers have divided the heavens around the sun into twenty-four parts, commencing at the east side of the sun. The vernal equinoctial point of course would be at 0 hour or at the end of the twenty-fourth. The north solstitial point is at the sixth hour. The autumnal equinoctial point is at the twelfth hour. Four of the above planets are now located between

the twelfth and the eighteenth hours. The following stars and stellar groups can be changed from their specific directions to the general, by keeping the above relations in mind:

Stars in groups.	*Hours east from 0.*	*Degrees from north star.*
Cassiopeia's Chair,	0—40	30
Algol,	3—00	50
Pleiades,	3—40	65
Aldebaren,	4—30	75
Rigel,	5—00	100
Capella,	5—00	45
Sirius,	6—40	107
Castor and Pollux,	7—40	60
Regulus,	10—00	78
Great Bear,	12—00	35
Spica,	13—00	101
Arcturus,	14—00	70
Vega,	18—40	50
Altair,	19—40	80

All terrestrial directions are dependent in location on the rotation of the earth. Along the meridians from the equator towards the north star is north. In the opposite direction is south. In the direction of rotation is east and the opposite direction is west. From the center is up and towards the center is down. Thus these two systems of directions and their relations to the earth can become as absolutely and well defined to the mind as the directions which relate the home and premises to the remainder of the terrestrial world. The rotation of the earth locates the poles, the equator, the parallels and the meridians. It is obvious that all terrestrial directions are dependent on the rotation of the earth except up and down. Were there no definite rotation or revolution there could be no definite relative directions on the

earth's surface. Any locality would be considered the base of reference, yet it would have no relations of direction existing between it and other positions on the surface. All positions and directions that may enter into the discussion of world relations refer to these two motions of the earth as the fundamental bases of reference,—the rotation for terrestrial directions and the revolution for celestial ones.

The earth being a sphere, many things which now seem necessary for the life of man could not happen were the earth flat. Were its surface a plane, the sun would appear the same to everyone on the earth's surface at the same instant. "Sunrise," noon and "sunset" would be presented to all, the same as to any one of the inhabitants of the sunlight side. All shadows on the earth would point in the same direction at the same instant. There could be no long or short days. It would be as hot at any one latitude as at any other the same distance above the sea level. There could be no climates having temperatures differing with those at Havana save in altitudes. There would be twelve hours day and twelve hours night everywhere forever. Topographical and isothermal lines would agree. No ice could form unless it froze at night. Every latitude would have the direct rays twice each year, and many other fantastic phenomena would happen were the earth a plane. Then many of our methods for studying the relations of the different portions of the earth's surface would be rational.

Since the earth is a spheroid and rotates with the

axis inclined to the plane of the ecliptic or its orbit, the form has everything to do with what actually happens. Long days and short nights succeeded by equal days and nights with alternations of periods of heat and cold, are facts peculiar to an inclined, rotating and revolving sphere. During the summer season at the north pole, the effects of the heat per daily temperature are far different from what is popularly supposed. To say that the north pole under the same conditions would become hotter than Havana or Para in extreme temperatures sounds paradoxical, but the rotation and revolution of a spherical body with an inclined axis to the plane of revolution can argue nothing else. The greater the inclination the greater the extremes of temperature will there be. The rotundity of the earth, its rotation, its inclined axis and its revolution give infinite variety to phenomena in respect to heat and light. To consider the advantages of rotundity or sphericity of the earth would fill quite an ambitious volume. It is sufficient to say that the earth would not be a very serviceable machine for the manipulation of the sun's energy in any other form.

The circular and linear dimensions are those considered in the circumferences of small and great circles and the various diameters of the earth. The dimensions of latitude are made on great circles and those of longitude are made on small ones except at the latitude zero. The greatest terrestrial linear dimension is one of the equatorial diameters.

Some of the foregoing geographic notions may be

more easily understood from the following illustrations which exhibit the relations of the earth to the sun's rays for six successive positions in its orbit (pages 52-53). The observer's positions are represented as being shifted on the plane of the ecliptic, such that the continents of North America and South America will present themselves as seen in the figures. For instance, in Fig. I, the observer is presented to a view of the earth in its position south of the sun, with the meridian of Cape Farewell at noon on the 21st of June. In each succeeding position, the observer has shifted his point of view so as to preserve the same relations to the illuminated portions of the earth. Each figure shows the earth receiving a cylinder of sun's rays. Only 8,000 miles of the direction of the rays at these particular instances are represented. The remaining dimensions of the directions and the sun are cast aside as not belonging to the simplest notions of the geographic order. The figures represent an earth of one foot in diameter. The sun is represented by inference only, and would be found 11,600 feet distant and having a diameter of 108 feet. Hence the effective rays received are represented by practically parallel lines, or directions.

Each illustration shows the earth receiving a cylinder of sun's rays which may be divided conventionally into annular areas, and named rays of torrid, rays of temperate, and rays of frigid effects. The rays are practically all alike in their respective capacities for generating heat on the earth's surface and their effects would all be alike were the earth

a plane. But since it is a spherical object, the rays effect the surface according to the laws of impact of matter in motion meeting resistance at different angles. This variance of impact depends upon the sine or cosine of the angle which the surface of earth makes with the ray. The most torrid or most direct ray has the effect of unity when compared with any other ray striking the earth. The most frigid ray has the effect of zero on the limb of the earth. All other rays have heating effects ranging from zero to unity. These heating effects of the sun's rays over the whole earth's surface are related to each other by a beautiful mathematical law—the relations of natural sines—such that any ray striking the earth's surface may be expressed in terms of the most direct ray. This law expresses the variance of the impacts in a line function instead of one of area. This means that the heat does not vary on account of being spread over a greater surface in higher latitudes or early and late longitudes, but on account of being the effect of a diminishing striking force of the ray against the earth. This diminishing effect of the rays by impact may be determined in all directions over the illuminated portion of the earth, from the position of the most torrid ray to the extremity of the earth's limb. It varies in longitude along the equator from noon to east and west on the days of the equinoctials, the same as at midday along the meridians, north or south of the equator.

The conventional annular areas, as shown in the illustrations, project themselves against the earth's

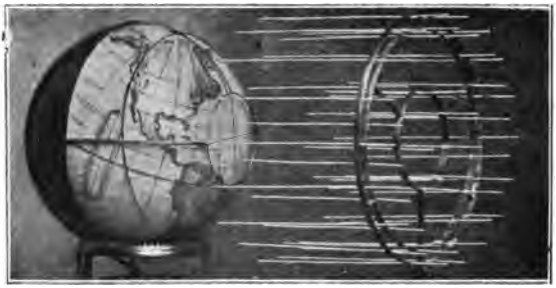


FIG. I.—JUNE 21.
Observer northeast of sun—earth south of sun.

FIG. II.—AUGUST 5.

FIG. III.—SEPTEMBER 22.
Observer northwest of sun—earth east of sun.

FIG. VI.—MAY 5.

FIG. V.—MARCH 20.
Observer southeast of sun—earth west of sun.

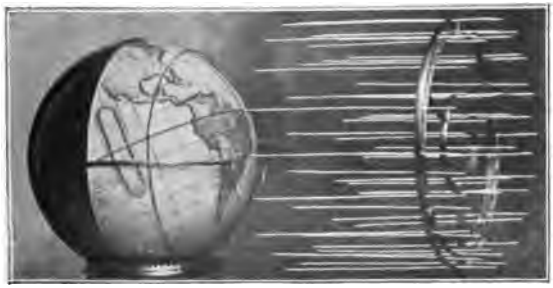


FIG. IV.—DECEMBER 21.
Observer southwest of sun—earth north of sun.

surface. The rays of torrid effect are located within the inner circle. The rays of temperate effect are located within the limits of the areas of the torrid and frigid effects. The rays of frigid effect lie between the limits of the rays of temperate effect and the limb of the earth.

Taking figures III and V for reference, it is seen that any point on the equator rises in the frigid rays of the morning, passes through them from 6:00 to 7:30, thence through the temperate rays of the morning from 7:30 to 10:30, thence through the torrid rays from 10:30 to 1:30, thence through the afternoon temperate rays from 1:30 to 4:30 (these periods are in round numbers), thence through the evening frigid rays from 4:30 to 6:00 p. m. during that day. In both figures the continent of South America is seen to pass in great part through all these rays, while North America at the same time is passing through the same kind of frigid and temperate rays only. All these rays are equally effective if permitted to strike the surface of the earth under like circumstances. The so-called frigid rays are practically as effective as any so-called torrid ray. It is safe to say that no thermometric device could detect any difference in their impacts were it possible to measure them before striking the earth. In geographic parlance, the earth means everything that has any tangible relation to it. The limits of the atmosphere are the limits of the earth's surface.

Taking figures III and V again, it is obvious that the most effective impact of the rays for any one hour of the rotation is on the equator from 11:30 to 12:30. This hour's heat may be taken as an unit of measurement for the earth's surface. On the 22d of September

any point on the equator receives the following amounts of energy per hour from 6:00 to 12:00 a. m. in terms of the standard or unit heat-hour. The following table is deduced from the terrestrial heat chart:

TABLE I.

6:00 to	7:00 a. m.	.13	of the standard hour heat.			
7:00 to	8:00 "	.39	"	"	"	"
8:00 to	9:00 "	.61	"	"	"	"
9:00 to	10:00 "	.80	"	"	"	"
10:00 to	11:00 "	.92	"	"	"	"
11:00 to	12:00 "	.98	"	"	"	"

The totality of heat for the forenoon amounts to 3.83 standard heat-hours. The entire day gives twice this amount, or 7.66 standard heat-hours. According to energy received, this is the hottest day for the equator during the year. The coldest days of the year on the equator are represented in figures I and IV, when it passes through the rays of frigid and temperate effects only. (See equatorial temperatures.) In terms of figures III and V, these rays strike any position on the equator from 6:00 to 10:30 a. m. and 1:30 to 6:00 p. m. According to the table above, the amount of heat for any position on the equator at this time of the year, the 21st of June or December, would be represented by 4.78 standard hours. The totality of heat received by any point on the equator from March 20 to September 22 is equal to 1088 standard heat-hours. The north pole during the same time receives 893 nearly of the same units. Now since the polar regions have a persistency of insolation, the paradoxical statement regarding the possible maximum temperatures at the regions of the poles compared with the maximum temperatures at the equator, has rational claims for credence. That is, *under the same conditions*, maximum temperatures at the pole may exceed those at the equator.

Figure I shows that the north polar regions

receive the same impact relations from the rays during the summer season that Chicago receives during the month of December. Also Chicago is represented as being three hundred seventy miles nearer the rays of most torrid effect on the 21st of June than the equator on the same day. From these absolute relations an inference may be drawn that the extreme temperatures should increase from the equator northward in our summer time and not southward to the equator, as is popularly understood. (See table II.) Under the same conditions, the interior of British America should have much higher temperatures in summer than any place in the United States and the north pole ought to exceed Para in the extreme temperatures.

Different views of the climates existing on the North American continent are easily obtained from the many correspondents of the great newspapers in their reports from the Klondike region and the occupation of Cuba. As to the latter many report "the mean temperature at Havana throughout the year to be 78-80 degrees Farenheit. The mean daily range does not exceed 6 degrees and the mean annual range does not exceed 20. The mean temperature in Havana of the hottest months varies from 82 to 85. The lowest rarely reaches 50 and the highest rarely exceeds 100. And although Cuba is well within the "torrid" zone, yet it has never known as high temperatures as North Dakota and Montana have almost every day in summer. Accustomed as we are to enduring 100 degrees of heat in the north, there is nothing but

delightful comfort down there during these months. August's mean temperature is 88 degrees and December's is 65. The climate is exceedingly healthful to whites and blacks alike. The great disadvantage is in the evenness of temperature and the constancy of brightness and warmth during the year." It is seen in the illustrations that ninety-four degrees of the earth's surface receive the rays of torrid effect during some time of the year. This hot circular area of 10:30 to 1:30 heat rays may be termed the "stove" of the earth and it is noticed that nearly every progressive and resourceful country of the earth takes its turn in passing through it during the year. See figures I, IV.

In contrast to the above, successful attempts at agricultural pursuits are related from the frozen wastes of Alaska. "Hillside exposures can be successfully planted and tilled and phenomenal crops of vegetables are raised. Work can begin about the first of May. There are few cloudy days, while the temperature is usually above 60 degrees, ranging to 80 degrees, and often it is much higher than this. In midsummer, the sun shines almost continuously and vegetation grows much more rapidly than in sections where there are less light and warmth in the twenty-four hours; for instance, in the United States. The whole country bursts into blossom and flowers cover hill and valley. A species of bees ply their busy trade, droves of deer and muskox graze on the luxuriant growth of mosses, and mosquitos become so intolerable that life is safe only by making secure protection against them. Wild fruits are abundant, consisting principally of raspberries, currants and cranber-

ries. The last named are found in great quantities over the whole country. Miners complain of the climate in Alaska as being too hot in summer and too cold in winter to carry on their work successfully."

W. E. Curtis, the celebrated correspondent, writes concerning temperatures across the equator: "The voyage from Panama down the west coast of South America, or rather, up the west coast, as the sailors say, 'down in Maine,' in defiance of geography, is one of the most charming that salt water affords. The weather on the south Pacific is always fair, and the heat is tempered by three causes—the antarctic current, the trade winds from the ocean, and, when they are lacking, by the breezes from the eastward, which are cooled to freshness as they pass over the mountain snows.

"The temperature has been very much cooler since we left Panama than it was at any time between New York and Colon. (See figures I, II.) On the Caribbean sea, the trade winds followed the ship and we got no benefit from them. The air was warm and sultry and the nights particularly uncomfortable, although we had deck state rooms with a door and two windows open and a transom in the roof. The thermometer on shipboard never fell below 84 degrees Fahrenheit after passing Watling's island, which is in 23 degrees and 56 minutes north latitude or about the same as Havana.

"We crossed the equator at 6:15 p. m. Sunday, July 2. The thermometer stood at 76 degrees in the chart room on the shady side of the ship and at 78 degrees in the companionway leading to the saloon. A fresh breeze was blowing from the southwest, the swell was a little

heavier than usual and a few white caps ornamented the surface of the ocean. After dinner that evening it was so cool that we pulled our chairs to the leeward of the cabin, the ladies put on light wraps, and about 10 o'clock, when I retired, the mercury stood at 72 degrees.

"On the Fourth of July, where we lay in quarantine in the Guaygas river, thirty-five miles below Guayaquil and three degrees south of the equator, it was doubtless cooler than in Chicago and New York. At 8 a. m. the thermometer marked 74 degrees in the companionway, at noon it was 76 degrees and at 4 p. m. it was 81 degrees. On July 5 it was 78 degrees when we went ashore to the city of Guayaquil at 8 o'clock in the morning. It was 84 degrees at 10:30 in the American consulate and 81 degrees at the club where we lunched at noon. That evening about 10 o'clock, the thermometer stood at 67 degrees in the chartroom of the steamer. Similar temperatures are found all along the coast south of the bay of Panama and, as I have said, is chiefly due to the antarctic current. On the east coast of South America, the thermometer will average twenty degrees higher in the same latitudes than on the west coast." (Figures VI, I, II.)—The author questions the last assertion of Mr. Curtis at that time of the year, May 5-Aug. 5.

The following table is compiled from the daily weather reports;

TABLE II—*Maximum Temperatures.*

	June.			July.		August			September.		
	26	28	30	2	5	2	11	20	5	6	22
Winnipeg	82	74	84	78	..	66	70	80	62	65	58
St. Paul	78	74	74	72	76	68	86	78	78	80	69
Boston	76	80	76	86	90	..	68	80	72	74	72
Chicago	72	84	64	86	68	72	84	90	198	77	68
New York	90	82	76	80	86	80	78	86	70	82	72
St. Louis	88	88	74	92	82	96	98	94	102	102	74
Vicksburg	84	90	88	90	80	96	92	92	96	94	80
New Orleans	76	86	88	80	90	96	92	84	92	90	78
Galveston	90	82	76	80	86	80	86	88	92	88	80

By the heat chart, the direct energy for any time of the year and for any latitude on the earth may be found by a few simple calculations. For instance, take the latitudes for every tenth degree north of the equator and compare the amount of energy each parallel receives for any day in June and the amount any position on any one of them will receive during the month. Some very surprising results will be found in respect to the amount of energy the supposed colder latitudes receive during the summer months. The table of temperatures might be misleading if the maximum temperatures for any one day be selected for a basis of comparison. The general average for an extended time is necessary to obtain data desirable to perceive relations existing between the energy received at any latitude and its temperature as shown by the thermometer. Local conditions will effect the temperatures—winds, proximity to great bodies of water, altitudes and ocean currents—while the amount of energy received at any place during the same time can be practically determined. The equator receives less energy from May 5 to August 5

than the latitude of Chicago on account of the latter having a greater length of day while the intensity of the rays at each place is practically the same for that period of time. The popular opinion concerning the supposed excessive high temperatures at the equator during our summer should not be entertained. See tables V, VI.

The heat chart is based on the direct ray and any great circle of the earth passing through the noon point on the plane of the ecliptic during any time of the year. It enables one to determine the impact of the parallel rays of a cylinder of sun's rays of 8,000 miles in diameter on any portion of the earth's surface. All the rays striking any meridian at noon time have the same relation in heating effect as the line of rays that strike the equator on the 20th of March or the 22nd of September. Hence the sine curve of heating effects on the chart relates to one another all rays that strike the earth during any time of day or any day or any portion of the year. The inclination of the earth's axis in the diagram is considered to be 24 degrees instead of 23½ degrees in order to facilitate calculations on the chart, as the number 24 contains a nice array of aliquots. The difference between the true results and those calculated by the chart are less than any result carried to its thousandth part, and is therefore correct for all practical purposes.

LENGTH OF DAYS IN THE NORTHERN HEMISPHERE.

Mar. 20.	Apr. 5.	Apr. 20.	May 5.	May 20.	June 5.	June 20.	Time / Lat.
12-00	12-00	12-00	12-00	12-00	12-00	12-00	0
12-00	12-11	12-23	12-34	12-44	12-47	12-49	10
12-00	12-21	12-47	13-08	13-27	13-34	13-38	20
12-00	12-32	13-10	13-42	14-10	14-21	14-27	30
12-00	12-43	13-33	14-16	14-53	15-08	15-16	40
12-00	12-48	13-43	14-33	15-15	15-31	15-40	45
12-00	12-54	13-57	14-49	15-36	15-55	16-05	50
12-00	13-07	14-26	15-32	16-28	16-58	17-17	55
12-00	13-20	14-55	16-14	17-20	18-00	18-30	60
12-00	13-45	15-40	17-25	19-10	20-55	22-40	65
12-00	14-00	16-00	18-00	20-00	22-00	24-00	66.5
Sep. 22.	Sep. 5.	Aug. 20.	Aug. 5.	July 20.	July 5.	June 20.	Lat / Time

TABLE III.

NORTHERN HEMISPHERE, MARCH 20—SEPTEMBER 22.

Latitudes.	Maximum Noon Ray Per Year.	Minimum Noon Ray Per Year.	Average Noon Ray Per Year.	Average Maximum Noon Ray Per Day.	Minimum Ray Per Day.	Average Ray Per Day	Average Length of Day.	Energy Per Day in Standard Hours.	Total Energy in Standard Hours.	Inclination of Earth's Axis.
Equator.....	1.00	1.00	1.00	1.00	.....	.638	12–00	7.66	1325	0
Chicago.....	.74	.74	.74	.74	.....	.375	12–00	4.50	837	"
North Pole.....	....	.....	.....	.....	.....	.....	.....	.....	.....	"
Equator.....	1.00	.91	.965	.965	.....	.488	12–00	5.85	1088	24
Chicago.....	.95	.74	.852	.852	.....	.426	14–00	5.96	1108	"
North Pole.....	.40	.....	.200	.200	.....	.200	4464	.....	893	"
Equator.....	1.00	.87	.945	.945	.....	.477	12–00	5.72	1063	29
Chicago.....	.97	.79	.900	.900	.....	.450	15–30	6.97	1196	"
North Pole.....	.49	.....	.245	.245	.....	.245	4464	.....	1093	"

TABLE IV.

Suppose a laboratory to be placed out on the plane of the ecliptic in which some imaginary experiments may be performed. Let the building have the dimensions of 50 feet in length, 25 feet in width, and 15 feet in height and containing two rooms. In one of them the experiments will be performed. The other will contain the apparatus. There will be windows on all sides of the building. The laboratory will be so squared to the universe that the floor and the long side of the building will be placed parallel to the plane of the ecliptic and the line joining the equinoctial points respectively. The house will be outside of the orbit of the earth. The sun will shine in at the north and west windows perpetually. The laboratory is supposed to be fixed on the plane of the ecliptic.

Were you to go to the east windows, the Milky Way would be a prominent feature in the eastern sky. It would appear as a great arch stretched across the sky from north to south. The highest portions of the arch would pass through Cassiopea's chair. The ends of the arch would pass through the northern and southern solstitial points. Now, if a view be taken from the western windows, the remainder of the Milky Way will be seen under the plane of the ecliptic with the lowest point near the Southern Cross. Neptune will be seen by the aid of the telescope on the level of the floor out of the northern windows. Forty years from now it will be seen in the west. Jupiter is seen in the southwest on the level of the floor. The sun is similarly situated as to the plane of the ecliptic, but a little to the north of west. From the north side of the house, the Milky Way will appear as an arch stretched up and down the heavens with the summer sol-

stitial point at the highest point. It will appear less broad than when seen on the west side of the house. The earth will revolve while performing these experiments. It will be necessary to take cognizance of its influence when in position of its nearest approach to the laboratory.

Take two one-thousand pound weights into the experiment room and place them fifteen feet apart. First, could one walk around the room? Could one walk across the ceiling as well as on the floor? How would one manage to shift those thousand pound weights? Let them be in the form of cubes. Would it be necessary to place them on a bench to operate with them? Would they remain three feet above the floor as well as on the floor? In going about the room would it be necessary to take more than one step? How would one contrive to turn around the corners? Would it be serviceable to be tied to different parts of the room? If shot be placed on the different faces of the cubes, would they have a tendency to settle near the centers of their surfaces? No doubt the weights could be pushed together easily. Would it be dangerous to get between them in a collision? If a string be attached to one of them and be given a jerk of sufficient force, would it break? Does the thousand pound mass possess weight? When the moving cubes collided, would there be a rebound? Would there be any danger of their getting out of doors if not stopped? Could one ride from place to place in the laboratory on a cube? On the earth, a moving mass strikes with a force of $\frac{MV^2}{2}$, will this hold good in the laboratory? Would a train of cars suffer a greater damage

in a collision on the earth than on the plane of the ecliptic, everything else being equal? Could a nail be driven into a hard board? While suspending some pound weights on spider's webs from the ceiling—it would happen that the earth was approaching from the southwest —would anything be noticed concerning these weights? Would everything have a tendency to move towards the west end of the building? Would they go out of the house if the windows were open?

Take a reservoir of water under pressure and turn the faucet on, will the water run out? In which direction will it flow? What would be the form of the stream? If directed out of the window would it ever stop its motion in translation? Would it ever come back to the faucet? Suppose the nozzle arranged to direct the water upwards, could a cup be filled? When filled, would it overflow? What would be the form of the water in the cup? Could it be drunk? How? Suppose a sphere of water be placed on one of the weights, would it remain perfectly spherical? Break the sphere of water into small globules like mercury, would they tend to gather at the centers of the faces of the cubes? Could one swim on a sphere of water? Take a sphere of water one foot in diameter and give it a whirl, will it tend to rotate about a certain axis? If some mercury be dropped on the surface of the rotating sphere, will the axis of rotation change? Where will the mercury finally go? Will the sphere rotate forever if not checked by some outside force? Will it bulge out at its equator? Let some smoke be made near the sphere of water, will it arrange itself around the sphere?

Could a nail be heated by pounding it? Would coal burn? Could a match be struck? Could electricity be made? Would a motor run? Could speech be transmitted? Would a telegraph instrument operate? A telephone? A phonograph? Wireless telegraphy? A water wheel? Would powder explode? Nitroglycerine? Would a magnet "attract?" Could one write with a pencil? A pen? Could iron be melted? Could it be forged? Cast into moulds? Would a clock run? A watch? Would a sphere of lead rest on an incline? In all these experiments, what so-called property of matter has there been lacking? The temperature in the laboratory is to be considered that for terrestrial bodily comfort.

SEQUEL TO PAGE 42

CHAPTER IV.

SPECIFIC GEOGRAPHICAL RELATIONS.

Heat, light, position, direction and gross motions.

What does the black in figures I-VI represent? How much of the earth's surface does it cover? How much of the surface is exposed? Why is the plane of the edge of the black perpendicular to the plane of the ecliptic?

What name can there be applied to the black surface? To the light surface? What is one-half of the black edge called? The other half? What may be said of the two points midway between these two edges, front and rear? Where is the pole of the ecliptic? The pole of the equator? How far is the pole of the ecliptic from the pole of the equator in degrees? What circle of the earth the circumference of which is in part always under the pole of the ecliptic? What is meant by "under?"

When is the pole of the equator on the edge of the black? What can be said of the length of the days at this time of the year? How do the meridians on the earth at this particular time act when passing along the edge of the earth's shadow, or line of demarkation, or circle of illumination? What can be said concerning the north pole from March 20th to September 22nd? Can the time of year be determined by the position of the earth's shadow on the surface? What causes the earth's shadow?

When the pole is furthest in the shadow, what time of year is it? When furthest in the sun's rays? Does the pole move in the sun's rays or does the shadow move

from the pole? How do the meridians compare in direction with the edges of the shadow on the 21st of June? On the 5th of August? On the 22nd of September? On the 5th of November? On the 21st of December? On the 5th of February? On the 20th of March? On the 5th of May? Can any deductions be made from these observations?

Do the meridians change their directions to the line of demarkation? Does the line of demarkation change its direction to the direction of the meridians? Can that part of the earth including the territory of the United States to date, the Pacific islands and all the islands between North and South America, be covered by the earth's shadow at one time? At what time of the year will it occur and for how long a time? What part of Spain must the United States purchase in order that Uncle Sam may make assertions as well as John Bull? Can he do so now? What is day? What is a day? Is there any distinction between the last two statements? What is night? What place on the earth has the shortest days? The shortest nights? The longest days and nights? What latitude nearest the equator has sixteen hours day? Twenty hours day? What time of the year has every latitude on the earth twelve hours day and night? Has every latitude on the earth six months of light and six months of darkness during each year?

Taking the countries of Manitoba, Siberia and Russia, can it be said that they receive more light than Cuba from March 20th to September 22nd? How many hours of darkness do they receive during these days? What economical fact does this suggest? How does each com-

pare in the quantities of energy received during the same time? What is the cosmic principle?

What is a solar day? A terrestrial day? A stellar day? A mean solar day? Explain where each begins and ends. Where is the international date line? How many of them are there? Which one of the days named above is determined by the date line? Which one is determined by the meridian of Greenwich?

What is time? Do all positions on the same meridian have the same time? The same day? The same date? What is the difference between day and date? What is noon? What is midday? What is twelve o'clock? Can the whole earth have the same Sunday? Show how a Sunday can begin at the same place that it ends.

Show how a part of Monday can be located between the ends of Sunday. Show how a part of Saturday can be located between the beginning and the end of Sunday. When it is five o'clock on Sunday morning at Manila what time is at Hong Kong? At London? At New York? At San Francisco? At Honolulu? Two events occur at the same time and have the same dates. Explain. Two events occur at the same time and have different dates. Explain. Two events occur at different times and have the same dates. Explain. Distinguish between time and date. The international date line and the midnight point, determine all facts concerning days and dates.

Is twelve o'clock m. in the middle of the day? What place is considered the middle of the solar day? Can it be noon at the end of a day? How many days can there be on the earth at once? What kind of days

are these? What are the greatest number of hours in each?

What is east? West? Can two persons be looking at the sun at the same time, the one looking east while the other looks west? At what part of the earth and at what time of the year can this be done? What is north? South? In what latitudes can the sun appear to be seen in the north at noon? In the south at noon? When the sun "rises" north of east at Chicago on the 21st of June will it rise north of east to the same degree at the same latitude south of the equator? (See figure I.) Will the opposite phenomena be noticed on the 21st of December? Will it "rise" north of east at the equator on June 21st?

What variations as to directions will there be at the same places at equinoctial times? (See figures III, V.) In preceding illustrations what represents the plane of the ecliptic? Can this be shown on the globe or map? Can there be a celestial east, west, north and south? Can there be a celestial up? Down?

Let the reader imagine himself away from the earth on the plane of the ecliptic with the face on the positive side looking at the north star. At what part of the year is the earth on the north side of the orbit? On the south side of the orbit? On the east side? On the west side? What countries on the earth are always on the upper side of the ecliptic plane? On the lower side? Suppose you are on the east side of the earth's orbit at the autumnal equinoctial time, will the illuminated portion of the earth be seen? At what time of year will that fact occur? When will the earth appear half dark and half light?

Do these changes remind you of similar phenomena? Are they made in the same manner? From the last named position of the observer when will the earth appear in its first quarter? In the last quarter? Distinguish between celestial up and terrestrial up. Can they ever coincide? At what place and at what time of the year?

Distinguish between celestial down and terrestrial down. When will these directions coincide? When will celestial north agree with terrestrial up? At what place on the earth? Celestial south? Celestial east? Celestial west? Where these celestial directions appear to meet the heavens, astronomers have given specific names. Can you give them?

At what time of the year and time of the day and particular places on the earth can one look celestially and terrestrially up at the same instant? Suppose one should look terrestrial up at noon on the 21st of June from the tropic of Cancer, in what celestial direction would he gaze? Same from the tropic of Capricorn on the 21st of December? Same at sunrise on the 21st of March?

Are the solstitial points and the equinoctial points holding perpetual celestial relations with the stars in the heavens? Define a solstitial point. An equinoctial point. Are they in existence during the entire year? Astronomers inform us that the earth is slowly twisting the axis of rotation such that the celestial directions are moving around on the plane of the ecliptic in direction opposite to that of revolution. And such being the case, in about 25,000 years the celestial directions will appear to have moved completely around the plane of the ecliptic. In 6,000 years from now what we now call the celestial

east will then be called the celestial north. And what we now term the celestial north will then be termed the celestial west. Since the time of Egyptian astrologers, this movement has been noticed and calculated. What is the astronomical term given to this movement? Could there be a precession of the solstitial points? In 12,000 years from now the then north celestial pole will be located in our now celestial south. The position can be seen at night in our terrestrial zenith at midnight on the 21st of June. In April and May it is seen after midnight. In July and August it is seen before midnight. It is near Vega.

The tellurian on page 68 represents the earth to the observer as though he were away from the earth, investigating its movements. The sun is not represented on the instrument on account of illogical relations being presented to the mind. The moon is purposely omitted for the same reason. Any apparatus used as a tellurian and representing the earth in working relations with other celestial bodies, transgresses pedagogical principles. If the sun be considered 93,500,000 miles away, having a diameter of 864,000 miles, and the earth having a diameter of 8,000 miles, how far away should the earth be represented from the sun if the earth be made of a one-foot globe?

How far from 2.2 miles would the earth be from the sun? How far from 30 feet would the moon be from the earth on this scale? Hence space relations between the earth and sun cannot be shown for practical purposes. Also time relations should be eliminated.

How many diameters of the earth equals one of the

sun? Supposing the sun to be represented by a twelve-inch sphere, the earth would be represented by a one-ninth of an inch shot, at a distance of 108 feet. To attain the conception of the magnificence in the space relations existing between the earth and sun, try this experiment. While at this distance consider that the sun is thrusting out, or dissipating lines of energy in all directions from its center. And, too, conceive how comparatively few of them strike against the earth. Now from what part of the sun does energy proceed toward the earth? Consider lines drawn from the opposite sides of the shot to the center of the sun. These lines will represent or enclose all the radial energy received from the sun, and are the most effective light and heat rays. (See figure VII). Also consider straight lines drawn from opposite sides of the shot to corresponding sides of the sun, or rather positions on the limb of the sun. All effects included between the two systems of lines or rays may be termed the indirect or light rays of the sun. The two shadows of the earth are caused by these two systems of sun's rays. Now suppose these lines to be cut crosswise so as to represent about 8,000 miles of their directions. Now expand the shot into a one-foot sphere, preserving the relations of the rays to one another. How much from parallel lines would the two systems vary? The most direct ray is in the center of the cylinder of the sun's rays. The most indirect ray is one of the elements of the cylinder practically speaking, and mathematically, or precisely, speaking it is an element of a cone of rays of which the sun is the base, and the apex of the earth's shadow is the apex of the cone. The most indirect ray varies in direction from the direct ray by .056

of an inch per foot. It is easy to represent this angle by two lines drawn on paper, but for any spatial representation the divergence would not be apparent on an apparatus. The most oblique ray of the radial rays diverges from the direct ray by .00052 of an inch per foot.

Since the radial lines represent the most energy that is thrust against the earth, they can be made in space by lines as nearly parallel as possible to make them. Hence all lines represented by the illustrations showing sun's rays may be considered as parallel directions. In nature, the most oblique radial ray which the earth receives, say at the north pole on the 20th of March, leaves the most direct ray about 2.7 inches per mile. These deductions argue that the mind must not conceive the sun anywhere on the apparatus. All that should be represented is a few miles of the directions of the rays before striking the earth.

The moon also should not be represented on an apparatus used as a tellurian. For were it placed within any practical distance, an eclipse of the sun would occur at every inferior conjunction and an eclipse of the moon would occur at every opposition. Therefore for true conceptions of these world relations, no sun or moon should be represented on an apparatus to be used as a tellurian. If correct relations would be conceived, the mind can be transported among the dimensions of the solar system on the plane of the ecliptic and there gain relations of the universe to the little earth, similarly as one may know something by the aid of drawings and models of the great cathedral, the grand cantilever, or our own splendid battleship Oregon.

To explain many phenomena of heat and light by the eye conception of the sun, we have accustomed ourselves to say, "The sun crossing the line, the sun going north and south, the sun rising and setting, the poles tipping toward and away from the sun,"—thus using the Ptolemaic system of geographic relations. By conceiving of the representations as shown on pages 52 and 53, it is obvious that the center of the earth always remains on the plane of the ecliptic, practically speaking, and that the cylinder of sun's rays is horizontally halved by the plane of the ecliptic. Then the rotation and the revolution of the earth causes these apparent movements of the sun. The saying is very trite, but there are many that are supposed to understand these relations who do not really conceive of them.

The celestial equator crosses the plane of the ecliptic at opposite sides of the earth—the earth may have sides—and is divided into two parts, the high and the low parts. The high part of the terrestrial equator is on the south side of the earth. The high part of the celestial equator is south of the sun also. The low parts of the terrestrial and celestial equators are on the north sides of the earth and sun respectively. When does the low part of the terrestrial equator get in the sunlight? The high part?

Quito is on the equator. At what time of day could the high part of the celestial equator be traced through the heavens at that place? The low part? Can Quito appear on the celestial north side of the earth? The equator is a terrestrial affair. The celestial equator is an astronomical notion. The plane of the ecliptic is an astronomical notion. What determines the equator? The plane of the ecliptic?

Should the earth cease to rotate, how many times in a year would Quito receive the direct ray? Would it be possible for it never to receive a direct ray? Can Chicago get closer in degrees to the plane of the ecliptic than the highest part of the celestial equator? How often? Does Havana touch the plane of the ecliptic? When, at noon? At sunrise? At sunset? At midnight? Which is the better to say,—the earth tips, or the parallels have high and low sides in reference to the plane of the ecliptic? What causes the seasons? What does the small ring in the illustrations, having two lines at right angles, indicate? What does the intersection of these lines indicate? If it is 47 degrees of the globe in diameter, will its top and bottom sides indicate the limits of the high and low sides of the equator? The center of the ring represents the place of greatest thrust of sun's rays against the earth's surface. Will the low side of the equator ever get into the center of the ring? The high side? What parts of the equator, in reference to the plane of the ecliptic, will receive the central ray? Will the whole terrestrial equator receive all the rays within the small ring during some time of the year? Is the sun as "hot" at 6 a. m. and 6 p. m. at the equator as it is at the middle portions of the day? Can the whole sun be seen at any time of the day? Then why is it not as "hot" at one time as at another?

Suppose the earth a plane 8,000 miles square. Then the column of rays received by the sun would be rectangular. Suppose also that it inclined to the plane of the ecliptic the same as the axis of the earth at present, would the rays at "sunset" and "sunrise" be the same as now? Would the rays at noon at Chicago differ with those at the equator? Would there be an equator then?

Would the north pole or thereabouts receive as direct rays as any other portion of the earth? Would the sun appear overhead anywhere on the earth at noon? At what time of the year would this occur? Would there be any equinoctial points in the heavens? Any solstitial points? Would maps of the earth be distorted in their higher latitudes? In their centers? Would Chicago, New York and San Francisco have noon at the same time? Where would day begin and end? Could a day ever exceed twenty-four hours in length?

Would telegraph poles then have any shadows on the 20th of March anywhere on the earth at noon? Do they now? Take the meridian of Chicago at noon, do telegraph poles of the same height, located on the same meridian, have the same length of shadow? Can they ever be in such relations to the sun that they will be equal? What does varying length of shadows to perpendicular objects on the earth and having the same height suggest? Is this a proof of the world being round or spherical? In the illustrations, would objects having the same heights placed around the most central ray, as indicated by the rings, have the same length of shadows? In what directions would all these shadows extend? If produced on the earth's surface through what place will they all pass? Is this true of any time of the year? At any time of the day? Would it be so if the earth were flat? Is this another indication that the earth is a spherical object?

Suppose that all the shadows at this instant be extended in both directions on the earth's surface until they meet, through what two points on the surface would they intersect? Would they intersect on a flat earth? Do

all rays striking the smaller ring have the same heating effect? The same with the larger ring? What name can be applied to the rays striking the surface within the smaller ring? Between the larger and smaller ring? Between the larger ring and the edge of the shadow? Were the earth a plane would there be any difference in the heating effects of these rays?

Is there a noon point on the plane of the ecliptic? What determines it? A midnight point? What determines it? A six o'clock point, a. m. and p. m.? What determines each? Can the places of six a. m. and p. m. be found for every position on the earth's surface? Are the effects of the rays the same at the equator from 6 to 7:30 o'clock each day in June that they are at the north pole? At what dates of the year does the equator pass through the frigid and temperate rays only? At what date does it pass through the greatest number of torrid rays? Does the tropic of Cancer ever pass in the same kind of rays? Which should receive the most heat on these particular days?

Do the meridians ever pass in planes perpendicular to the plane of the ecliptic? How could you locate this plane at any time of the year? Do the hour meridians of the earth divide the equator into equal parts? How many miles in each division? Do they also divide the celestial equator into equal parts? Do they divide the ecliptic circle into equal parts? Why not? What is sun fast? Sun slow? What is a mean time? Solar time? What is stellar time? What is a day of revolution? Suppose the earth rotated in the opposite direction, would it make any difference in the length of our days? Would a solar

day be longer or shorter than it now is? Would it exceed a stellar day? Would Chicago be east of New York then? Would there be as many days in a year as now? What becomes of those fractions of days at the end of each year? Suppose they were permitted to escape our attention, what would happen? Are there any countries on the earth that have omitted to take account of all of them since their history began? Can the mistakes be rectified?

Were the earth to rotate faster would the days be any shorter? Would there be as many hours in a day then? Would there be as many days in a year? Suppose the earth to revolve at a greater speed, would there be as many days in a year as now? Would the days be any longer? Would the hour be any longer? Would a solar day be affected thereby? Would our sense of time change? Would it make any difference to vegetation? To mankind? Could one live to be a thousand years old if the earth revolved fast enough?

Which is the hotter in respect to the energy received from the sun, 2 o'clock p. m. or 10 o'clock a. m.? Seven o'clock a. m. or 5 o'clock p. m.? Why is it more generally of a higher temperature at 4 o'clock p. m. than at 8 o'clock a. m.? Which would be the hotter, 60 degrees east or west from the noon point on the equator, or 60 degrees north of the noon point on the 21st of June?

By the heat chart, how much heat does each place receive on that day? If at 60 degrees north at noon, the hottest ray strikes with an effect of .80, while at the equator it strikes with an effect of .91, and at sunrise and sunset the rays strike equally, the whole effect for each place

may be easily calculated. The length of day for each place may be found in table III. How far from 6.50 and 5.60 standard heat-hours respectively, do they receive that day? What economical fact does this suggest?

Investigate the tabulated calculations in tables V, VI, taken from the heat chart. Why should latitude 30 degrees receive more heat from March to September than the equator during the same time? Does Chicago receive more heat in the same time than any position on the equator? What is the greatest amount of heat that can be received at any latitude during 24 hours? Where is that place? What time of the year is it? Compare it with the amount of heat that any position on the equator may receive during the same time. If the north pole gets 9.6 heat-hours on June 21, why should it not get hot there under proper conditions? The north pole has seven days more of summer than the south pole. What fact does this statement suggest? In 12,000 years hence, the south pole will have seven days more summer than the north pole. What will occasion this reversal? Explain The path of the earth around the sun is said to be elliptical in form. The sun is said to be on one side of the center. In what celestial direction is it from the center? The path is also said to be divided into two unequal pieces. On which side of the sun is the shorter part? What time of the year is the earth in the shorter part of the path? What makes this division? Will the earth make a greater number of revolutions while in the longer part of the path? What relation does the north pole bear to the sun during this time? The south pole? It is also said that the earth is nearer the sun on the celestial north side

of the sun. Is the earth any warmer thereby? Do you think the north pole will begin to get colder in the next few thousand years than it now is? Will this period of time have any effect on British America and Alaska?

The rays of temperate effect may be termed the 7:30 o'clock to the 10:30 o'clock, or the 1:30 o'clock to 4:30 o'clock rays. The rays of torrid effect may be termed the 10:30 o'clock to the 1:30 o'clock rays. This has reference to rays striking the equator at equinoctial times. What may the 6 o'clock to 7:30 o'clock rays be called? Were the north pole surrounded by land, would it become a very warm place? Would it be colder in winter? Which is the hotter, Cuba or Manitoba in July and August? Which has the cooler nights? Suppose the earth a sphere of water, would the isothermal lines follow the parallels of latitude? Where is the "torrid zone?" The "temperate zone?" The "frigid zone?" Do not teach zones. Is it the amount of energy or the evenness of temperature that enervates the human race in tropical climes? Could not bananas be grown in Alaska were it not for the winter? What positions of the earth have the highest recorded temperatures? The lowest? Throughout the Mississippi valley on September 5 and 6, the temperature ranged from 80 to 104 degrees Fahrenheit. How would the extreme temperatures at the equator compare at this time? What are isothermal lines? Are there isothermal zones? Do they shift in latitude? What do you understand by the term energy? Energy is engaged in great quantities in the form of wheat and corn on the broad plains of the Mississippi, Red River and La-Plata valleys. Famines occur in India and Russia. As

COMPUTATIONS FROM THE TERRESTRIAL HEAT CHART.

Latitudes	Maximum Noon Rays.				Average Noon Ray, Mar. 20-Sep. 22.	Minimum Ray Per Day.	Average Ray Per Day	Average Length of Day, Mar. 20-Sep. 22.	Average Heat Hours Per Day.	Standard Heat Hours Mar. 20-Sep. 22.	
	Sep. 22 Mar 20.	Aug. 21. Apr 21.	July 21 May 21.	June 21.							
0	1.00	.99	.96	.91	.965	.....	.488	12-00	5.85	1088	Summaries Last Column Next Page.
10	.98	1.00	.99	.96	.985	.....	.492	12-40	5.94	1151	
20	.94	.98	.99	.99	.980	.....	.490	13-00	6.37	1184	
30	.86	.93	.96	.99	.940	.....	.487	13-30	6.57	1222	
40	.76	.84	.91	.96	.870	.....	.447	14-00	6.25	1162	
50	.64	.74	.82	.91	.780	.....	.397	14-20	5.70	1060	
60	.50	.61	.72	.81	.660	.....	.345	15-40	5.40	1004	

SUMMER—NORTHERN HEMISPHERE, 186 DAYS.

TABLE V.

COMPUTATIONS FROM THE TERRESTRIAL HEAT CHART.—*Continued.*

Latitudes.	MAXIMUM NOON RAYS.				Average Noon Ray. Sep. 22-Mar. 20.	Minimum Ray Per Day.	Average Ray Per Day.	Average Length of Day Sep 23-Mar. 20.	Average Heat Hours Per Day.	Heat Hours Sep. 22-Mar. 20.	Hours of Heat Entire Year in Terms of 11:30 to 12:30 on the Equator March 20 or Sept 22
	Mar. 20, Sep. 22.	Feb. 21, Oct. 21.	Jan. 21. Nov. 21.	Dec. 21.							
0	1.00	.99	.96	.91	.965	.....	.488	12–00	5.85	1047	2135
10	.98	.95	.90	.83	.915	.....	.458	11–20	5.19	929	2080
20	.94	.88	.80	.71	.832	.....	.430	11–00	4.73	847	2031
30	.86	.78	.70	.58	.730	.....	.376	10–30	3.94	705	1927
40	.76	.66	.55	.43	.600	.....	.300	10–00	3.00	537	1699
50	.64	.53	.40	.26	.460	.....	.230	9–40	2.21	396	1456
60	.50	.37	.22	.10	.300	.....	.150	8–20	1.25	224	1228

WINTER—NORTHERN HEMISPHERE—179 DAYS.

TABLE VI.

much energy falls upon the latter countries per acre as upon the former. What causes the famine? Is it the ignorance of the people, their excessive numbers or their poor instruments for manipulating or distributing energy? Think of anything that is good or great or lasting on the terrestrial sphere and consider whether it has, or ever will have, anything to do with the rightful dissipation or manipulation of energy—the welfare and happiness of mankind.

What is the rainy season? In what rays of the sun will it always be found? Is it always in evidence? How far on each side of the equator does it extend? What is the dry season? What causes it? Can a place have two wet seasons? Does Havana have a wet season? Hawaii? Madagascar? Philippines? Will hurricanes occur at these places during the dry seasons? Why can a place not have three wet seasons in one year? What correspondences have dry seasons and winter?

Suppose the earth not to rotate or revolve, how would isothermal lines be arranged on the earth's surface? Would there be a hot place on the earth? A cold place? A temperate place? Where would it rain all the while? Snow? What would eventually become of the greater portion of the ocean? What would be the shape of the earth's surface towards the sun? (Figure III).

Where is the pole of the ecliptic? Suppose the north star and it were at the same place in the heavens, would there be any change of seasons? How many hours would there be in a day then? Since there are a number of days having different names, it will be well to distinguish them before quitting this theme on heat, light and gross motions.

There are the solar day, the mean day, the stellar day, the terrestrial day and the day of revolution.

The solar day has to do with the movement of any prime meridian across the direct ray.

The stellar day has to do with the apparent movement of a particular star across a prime meridian, or each rotation of the earth. Since the solar day is effected by two movements of the earth, and the stellar day by one—the rotation—it is seen that the solar day will compel the earth to turn each day a fraction of a rotation more, to make up for the angle of revolution. What is the angle of revolution? The angle of rotation? A month belongs to an angle of revolution of the moon.

The day of revolution occurs on all planets proceeding around their luminaries. The earth's shadow proceeds around it in one year. The moon's shadow proceeds around it in one month. Three hundred and sixty-five solar days, plus one day of revolution, equals the number of stellar days in one year.

The solar days are of unequal lengths during the period of a year. When closest to the sun the earth travels at a greater angular velocity, hence more of the day of revolution is angled into the solar day than on the opposite side of the orbit, where the angular velocity is less. Consequently the solar days are of unequal lengths and a good time-piece points out the variations during the year as the sun being fast or slow. Man has fixed up a day of his own in order to be just right on all occasions of church and state. It is a compromise between man and nature. The stellar day is regular and never varying a second of time in a hundred years. The solar days are

irregular in length during the year. The mean day is a compromise between them, such that there will be as many mean days during the year as solar days, yet each mean day will have the same amount of time included in it throughout the year. It is, therefore, an average of the solar days. It has 24 hours, and time-pieces in observatories are set to measure it out. It is a day made as though the earth revolved around the sun in a circular orbit. Man, however, is careful to adjust his calculations such that no time will be gained or lost by the end of the year. The earth has a small fraction of a rotation left over at the end of each year with which man has had some trouble in times past to handle. There are some people today who are quite conservative in their world relations, and persist in the custom of keeping their chronology in the fashion of notching a stick, meaning of course that every solar day is to have a regular mark of identity. They can be appropriately termed old-styled and behind the times. How long since has it been that our western civilization took a "hitch" in its time? How have they regulated affairs in order to obviate the necessity of these days? It is said that the Bear will make a correction in 1901, in order to agree with the Eagle and the Lion. Suppose the fact would go on unheeded, what disarrangements would happen in society? Would it be appropriate to celebrate Easter with the spirit of mind that manifests itself in December's chilling blasts? Would Easter occur on the 4th of July if man did not provide himself with leap years? Would it occur in midsummer?

The terrestrial day has to do with the surface of the earth, using the international date line as a basis of refer-

ence. It begins there. It ends at the midnight point. It is named Sunday, Monday, etc. Commerce has placed the international date line on the 180th meridian from Greenwich. Parts of two terrestrial days are on the earth at the same time, but no more. Terrestrial days are named. All other days are numbered.

Suppose the earth to revolve in the opposite direction around the sun, how many solar days would there be? How many stellar days. Why would they be the same in number then? Would the solar day be shorter? The mean day? The terrestrial day? The day of revolution? Which of them would vary in length if the rate of revolution be increased? The rate of rotation? Would time be influenced thereby? What is time?

Time is a consideration of motions. As an entity it has never been defined. The subject has had the attention of many writers from an early date. Aristotle, Zeno, Newton, Leibnitz and Kant have each given a definition, but no two of them agree in their predicates concerning it. Many modern writers take it as an undefinable entity and use it as an absolute factor of objective reality. However, whatever the term may be, it may be classed as a derivative, and then predicated, and thereby determined. Time, as man conceives of it, is a derivative term. That it is an entity, is but an apparition. That it is unchangeable and eternal is also another notion of world relations, gained by man measuring nature by his small molecular dimensions. Were it possible for him to go beyond the realms of terrestrial dimensions, his sense of time would be far different from that learned upon the earth. Were he to take a majestic flight through the universe similar

to that of the celestial "tramp," his sense of time would be as naught. It would be an irregular, undetermined conception, as no two percepts of which could have any basis of comparison. His rates of travel would be irregular, and his time-piece would appear to act accordingly. As it is, the human race has been contending with the rotating and revolving earth since the dawn of reason. It has conceived of the two apparitions, the east and west and north and south movements of the sun over the surface of the earth, and has compared them, the one with the other. So far as the naked eye could determine, these two motions have been uniform. Contrasting these two motions, man has made a quantitive measurement. One of them he has used as a divisor for the other, and the resulting ratio is what man is pleased to term as time. Time, then, is the ratio of two uniform motions, and without the contrast of two uniform motions there can be no conception of time.

Since man can manipulate matter and motion in many ingenious ways, he builds chronometers of wonderful precision to indicate the earth's motions. The contrast of the motions of things with the motion of the chronometer is termed the time of the objects. Should the time-piece move irregularly no time concept could be determined for the movements. The predicate of time, the relativity of motions, can be appreciated by man during his sojourn on earth. The time of the child seems wearisome and long. The sun drags to the zenith and lags lazily along his downward course. In middle life, time appears shorter and one finds insufficient time to meet the require-

ments of a busy and useful life. Winter goes, summer slips by and winter is on again. Old age sees time flit by with the coming and the going of the swallows. The contrasts of youth are remembered. The realization is no idle fancy. A truth is hidden there. Time appears to be a lengthening entity. The conception of time having length, has its cause of being in man himself. A variable concept of the activities of man with the motion of the earth is conceived. The moving blood has its movement appreciated at every nerve's end. A ratio is established between the coursing blood and movements of the earth. One of the movements registers his minor activities. The other measures them in more comprehensive ratios. A variable motion of the activities of man for a life-time has been measured by a uniform motion of the revolving earth. The divisor cut off less and less portions of the variable activities as the years rolled by. Hence the concept of a variable time on earth derived from a ratio of motions.

Could there be any time concepts without a contrast of uniform motions? Suppose all motions to be in the same direction and at the same rate, would there be any time concepts? Suppose all dimensions to be the same in length, would there be any sense of space? Could space be considered a ratio of dimensions? Could the conceptions of space and time be considered as derivative terms from the conceptions of matter and motion? Are not position, direction, matter and motion the most fundamental concepts that can be gained from all objective reality? Are not all other world relations whatever, de-

rivatives from them? Fundamentals above them are but relative terms. A notion may be a derivative from fundamentals below, and at the same time be a fundamental to derivatives above.

CHAPTER V.

THE ASTRONOMICAL ORDER OF NOTIONS.

SYMBOL A ○.

Unit, the solar system. *Limit, the visible universe.*

The two fundamental stresses of the world effecting the earth, are gravitation and energy from the sun. Gravitation may be termed lines of ethereal motions proceeding in all possible directions in the universe. To conceive of this, take any position in space and imagine the possible radii that can be drawn from it as a center. Then to each radius there can be drawn an infinite number of parallel lines throughout the universe. Each one of these lines considered, may represent the direction of a line of universal gravitation. Since no line of motion can be considered as having a greater stress or force of translation than any other, reason will be justified in concluding that the summation of these stresses of gravitation is equal to zero, and that, were the universe devoid of gross matter, it would be in a state of equilibrium. And since gross motion can not be conceived without the presence of gross matter, lines of ethereal motion, whether of energy or gravitation, may be considered as lines of subtle matter acting against gross matter. Gross matter consists of such substance that is effected by lines of energy and gravitation. Subtle matter may be considered under the name of moving particles of ether.

Lines of motion act along directions of least resistance. In homogeneous substances, this direction is the shortest distance between two points, and is consequently

a straight line. Let ether substance be considered a homogeneous arrangement of straight, moving particles, and that lines of gravitation are particles of ether in straight line motion. Every mass of gross matter tends to impede the progress of the lines of gravity from passing through, similarly as a sparse forest may resist the progress of the wind. And, since the lines of motion proceed from all possible directions, there is no point in space but what has an infinite in number of gravity lines tending to pass through it. Hence every mass of gross matter is pressed upon in directions of its radii by the moving particles of ether from every possible direction in the universe. And should a mass of gross matter be homogeneous in construction and have no rotation, it is obvious that it would be made thereby into a spherical form. Then this celestial force or motion, pressing upon the earth from all possible directions, is the cause of its being a spherical body. The sun likewise is a rotund form and the moon and stars and every other independent mass of celestial gross matter in the universe.

These lines of universal gravitation tending to pass through a mass of matter, agitates or imparts a certain amount of motion of the ether particles to it. The ether particles are caused to change their directions of motion while passing into the mass. The greater the mass and density of the body, the greater the resistance is there offered to lines of gravitation passing through, and also the greater number of ether particles are there intercepted. The combined effects will the greater intensify the motions of the elementary constructions of the gross matter. The senses interpret the degree of this intensity of

motion by the amount of radiant energy or modified lines of gravitation that are sent away from it, and popularly term it heat and light. A law may be deduced from this conception of the action of ether particles against any celestial body for the amount of ethereal motion it will constantly and continually radiate to space. The law determines the amount of resistance which any celestial body offers to the passage of the lines of gravitation through it. The resistance is proportional to the mass and density product of the celestial body. Therefore the mass and density product of a celestial sphere will be an index to its absolute temperature, its power to resist or modify lines of gravity, or its capacity to radiate or dissipate energy. This law will indicate the comparative absolute temperatures of the different members of the solar system to be as follows:

TABLE VII.

Earth	302.	Sun	25,000,000.
Venus	202.	Jupiter	22,900.
Mercury	83.	Saturn	3,730.
Mars	23.2	Neptune	1,044.
Moon	2.6	Uranus	967.

The earth by this deduction is not so hot a body as the sun because it offers less resistance to the lines of gravity passing through it. The earth is warmer than the moon and cooler than the larger planets. The earth compares more nearly with Venus in absolute temperature than any other member of the solar system. The moon shows itself the coldest and the sun the hottest of the system. Thus it seems that the sun is a perpetual sourse of radiant energy, and its power will never diminish so long as its

mass and density product remains a constant. It will never become any hotter or any colder, though the surface may become completely covered with spots, provided the mass and density remain undisturbed. The same argument will hold good for the earth and every other celestial mass of gross matter in the universe.

Every celestial body radiates its modified gravity lines, and, if the radiation be sufficient to effect the organs of sense, the bodies are called heated and luminous. Then taking it all in all, the force which so unmercifully pushes us to the ground when we stub our toes, or causes the fluffy snow to fall, or the mighty avalanche to thunder down from awful heights, or Niagara's flood to roar, may be the same that moulds the earth to spheric form, gilds the sun and glints the stars.

Every object on the earth's surface is pushed toward its center because the lines of gravity are permitted to act against one side with a greater stress of translation than on the opposite one. The lines of gravity from above, which pass through this book substance, find some resistance to their motion. The resistance is popularly termed weight. There are gravity lines tending to come through it from the opposite side, but the earth intercepts them to such an extent that there is a difference in the respective pressures. The result is a tendency of the book to be pushed towards the most intense vacuum of opposing forces. This of course is between the book and the center of the earth. Were the book denser, the lines of gravity would find a greater resistance in getting through, and the senses would interpret it as being a heavier book. Also were the earth larger or denser, or both, the lines of

gravity would be the more completely intercepted from the under side of the book and thereby it would be made heavier. Its weight would be made greater on the surface of the sun and less on the moon than on any planet whose mass and density product lies between these extremes. This celestial force which gives weight to objects on the earth, gives weight to every dependent object in the universe. The greater the mass and density products of the celestial bodies, the greater the weight of the dependant objects. Were there not a second object, nothing could have weight.

When objects obstruct lines of force from one another, they are said to attract one another. Why are they not pushed towards one another? In fact, the critical world does not take kindly to the attractive theory of gravitation. It has stood many minds in awe on account of its supposed maintenance by the discoverers of the laws of motion and the law of gravitation. No one can accuse Newton of advocating the theory, for he did not believe in it. Attraction of matter and the gravitation of matter are quite different things. The law of gravitation is true and it expresses a relation that exists between the factors of all objective reality. But the theory of attraction of matter, which demands for its support the continuity of matter, can not be translated into that form of thought necessary for the mind to make any conclusive judgment. And, so far as the mind is able to interpret the relations existing between gross matter and gross motions, a discontinuity of matter will debar it from accepting the attractive theory of gravitation. It is believed that the translation theory of the ether particle will satisfy

every physical requirement, and at the same time will appear rational. This theory also rejects the elastic properties of a stationary ethereal substance.

Man utilizes the gravity lines and their modifications to aid him in his many vocations. Pile drivers, water-wheels, motors, dynamos, sailing vessels, windmills, hydraulic rams, gas and steam engines of all kinds are machines to manipulate them directly or indirectly. Yet before some of the instruments can be used at all, another force must be considered. All dependant and relative or gross motions are the consequences of the actions of two opposing forces, or the difference in rates of translation of two systems of motion in the same direction. The one furnishes resistance for the other and thus makes a basis for all motions in gross form. The lines of gravity will be considered as one of these general forces. The lines of energy will include all opposing forces whatever. Then all dependant motions on the earth's surface in the ultimate analysis can be reduced to the difference in stress between lines of gravity and lines of energy as manifested by gross matter.

Most of the earth's energy comes from the sun. It may be termed the motion of a gravitation particle modified into several factors of motion. The sun may be termed a machine for modifying lines of gravitation into lines of energy. The earth may be termed a machine for modifying lines of energy into forms of organic life. The sun may modify lines of gravitation into lines of energy by impressing upon the ether particle a series of complex motions while in the progress of translation. The most simple modification of movement to the particle

would be to describe an orbit while in motion of translation. The entire movement of the particle through space could be termed that of a spiral or helix. Thus a particle of energy would describe a sinusoidal path if projected on a plane parallel to the direction of translation. (Figure IX). The earth intercepting these lines of energy with the molecular constructions of gross matter gives basis for the lowest forms of motion in the biological order, and which forms may be termed a manifestation of life. They are the activities of the vegetable world. The energy afterwards is dissipated, or disengaged, and which action is a form of death of the first order. The released energy particle escapes to space, where it begins another cycle of infinite dimensions.

By the ether particle losing its minor factors of motions, the line of energy becomes a line of gravitation, having its original movement in a straight line. This is the requirements of the law of conservation of energy, or rather this action, translated into words, is the law of the conservation of energy. This is the only example of perpetual motion. Infinite relations having any motion at all demand it.

The sun radiates its energy in all directions from its center. Its lines of energy proceed in greatest stress along directions of radii outwardly from every point on the surface. Supposing the surface to be a highly heated gas under extreme tension, the molecules move with greatest thrust opposite the greatest portion of the sun's mass, behind them respectively. Hence the strongest thrusts of energy will act along directions of radii of the sun. The earth intercepting a comparatively small rod,

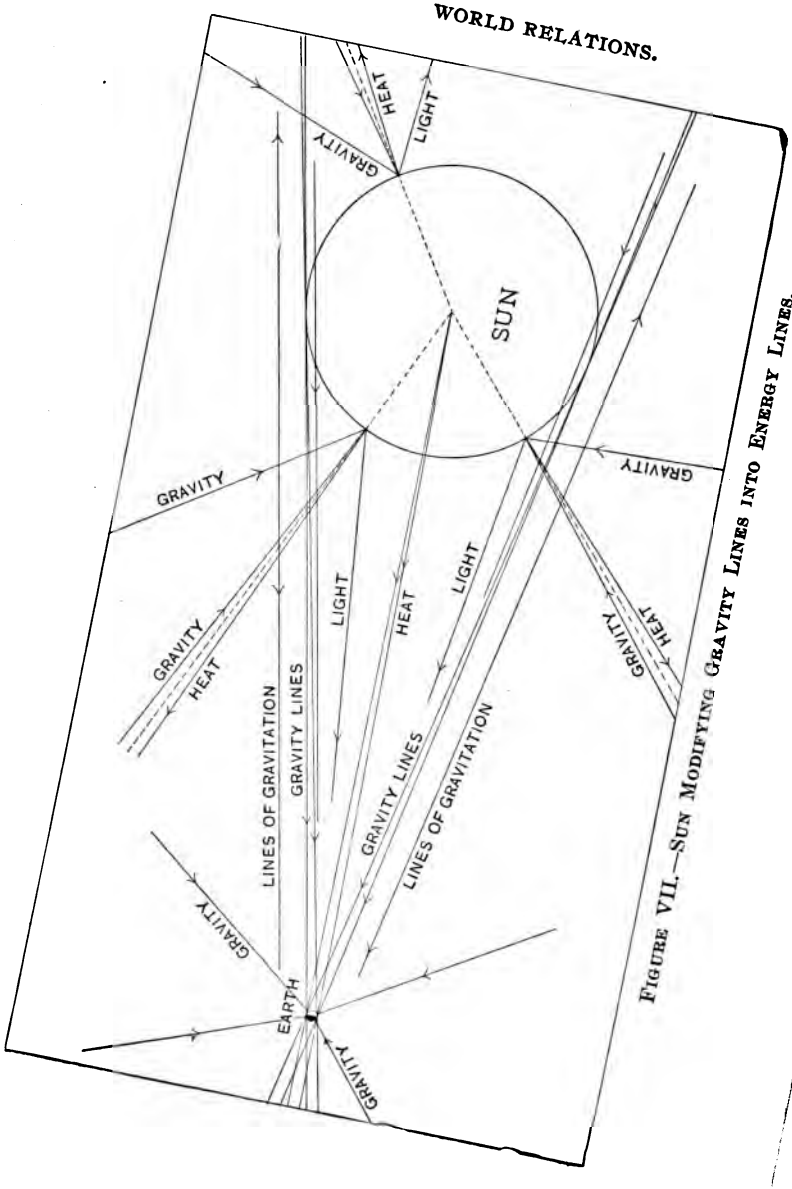


FIGURE VII.—SUN MODIFYING GRAVITY LINES INTO ENERGY LINES.

bundle or column of these rays or lines of energy, offers resistance to them, and this resistance or impact, as it may be called, may be perceived as heat and light. Heat and light effects may be considered as distinguished by differences in the radial and the angular thrusts of the ether particle from the sun's surface. Since the molecules may not leave the sun's surface under normal conditions, the ether particles or energy wrappings, which become dissipated or disengaged, proceed along the direction of radii without loss of motion into space. Of the entire motion of the ether particle on leaving the sun, one of its factors will indicate the motion of the particle along a solar radius, and it may be termed a radial thrust or factor of translation. The orbital factor revolves the particle and causes it to describe a helix around the axis of translation. Other factors may enter into the form of the movement and make it highly complex.

The sun being a certain mass and density product, will modify the gravity particles in a different manner compared with the earth. The lines of energy sent out by the earth may not be so extensive in their minor motions as those sent out by the sun, and consequently may not materially differ from gravity lines. The lines of gravitation, after intercepting the sun, leave it at a slower rate of translation than they had before intercepting it on account of being impressed with the many factors of motions.

If the factor of translation of a certain particle of energy be estimated at a velocity of 186,330 miles per second, the gravity line would be as many times greater in velocity per second as the length of the rectified path of

the energy particle exceeds the length of its factor of translation for the same period of time. Supposing, for instance, the energy particle as having but two factors of motion, those of orbital and translation, the velocity of the line of gravitation may be estimated as follows: The two motions of the energy particle combined would give to it a sinusoidal path if the trace of the particle in space be projected against a plane parallel to the direction of the factor of translation. Supposing the particle to describe a helix—a straight line wrapped around a cylinder (figure IX)—the length of the cylinder will represent the motion in translation. If the helix be unwrapped and laid out on a plane, the factor of translation will be represented by the base of right triangle. The diameters of the orbital motion will be represented by the perpendicular side.

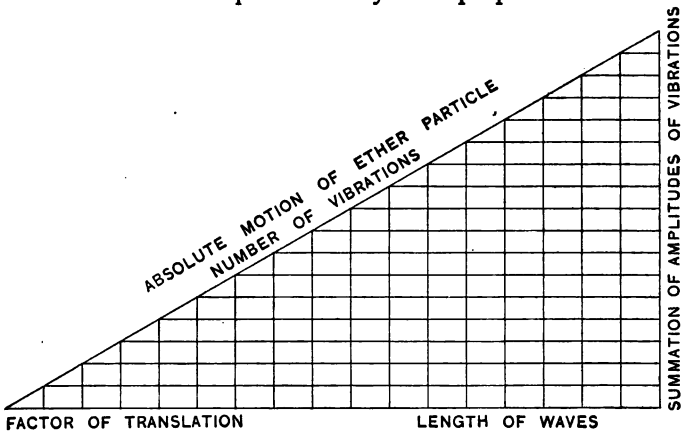


FIGURE VIII.—RELATIONS OF FACTORS OF MOTION.

The hypothenuse will represent the absolute motion of the ether particle. Thus it may be seen that the greater the

orbital motion of the energy particle, the less the amount of motion it will have in translation. If the factor of translation equals zero, the ether particle is wholly a heat effect, an arrested impact or a torrid ray.

Taking for granted that the ether particle has an absolute velocity that can not be altered, what can there be said as to its velocity in a straight line—a line of gravitation? The velocity of the energy particle in light form, regardless of color, is 186,330 miles per second. And not knowing from which part of the spectrum it may come, let us take for argument's sake, the green light as a basis for calculation. The number of vibrations per second of heat and light transmissions in ether, as deduced by Brauson, is as follows:

TABLE VIII.

Roentgen rays,	288,224,000,000,000,000
High limit of photographic spectrum,	1,125,900,000,000,000
Green light,	562,949,953,000,000
Low limit of photographic spectrum, red	281,474,976,710,656
Heat rays,	70,368,744,177,664

The above table coupled with the theory now under treatment may indicate that the greater the velocity of translation of the ether particle, the greater the number of vibrations per second. It is true that if the ether particle has an absolute velocity, that the amplitude of the vibration will vary inversely as the number of vibrations per second. It is also true that if the energy particle travels in the path of a helix that the translation will vary inversely as the amplitude of the vibration. Consequently the following formulae may be expressive of relations existing between the factor of translation, the orbital factor

or amplitude, the absolute velocity of the ether particle and the number of vibrations per second:

(1) Factor of translation varies $\frac{\textit{Absolute motion}}{\textit{Amplitude of vibration}}$

(2) Amplitude of vibration varies $\frac{\textit{Absolute motion}}{\textit{Number of vibrations}}$

By substituting (2) in (1) the following result will be attained:

(3) Factor of translation varies $\frac{\textit{The number of vibrations}}{\textit{The number of vibrations}}$, that is, the greater the number of vibrations, the greater the velocity of the factor of translation. If the number is infinite, the velocity of the ether particle is infinite, a result which will permit the theory herein discussed a range absolutely necessary for its maintenance. Then the first deduction from the table above will be to find the velocity of the ether particle therein considered. Applying to green light whose velocity is 186,330 miles per second, the equation from formula (3) gives:

Factor of translation for extreme violet ray equals $\frac{1{,}125 \times 186{,}330}{562}$

as the velocity per second, which is372,660 miles.

Table IX are deductions from the formula (3) and the vibrations of heat and light set forth in Table VIII.

TABLE IX.

VELOCITIES IN ENERGY TRANSLATIONS.

Veloc. miles per sec. ether particle in the Roentgen rays	95,000,000
Veloc. miles per sec. ether particle in the Violet rays	372,660
" " " " " " " " Green "	186,330
" " " " " " " " Heat "	23,280

Now, a line of gravitation exceeds the velocity of the Roentgen ray as much as it exceeds it in number of vibrations in the same period of time. And since in comparison to the number of vibrations that may be found in the ethereal substance per second, it will make no material difference in the result whether the basis of the calculations be taken from the violet or the red end of the spectrum. Hence to the finite considerations of man and the velocities he may conceive, the line of gravitation can be easily accounted as an ether particle in a straight line motion having an infinite velocity. Figures VII, VIII and IX are illustrative of the relations of the ether particle and its motion in heat, light and gravitation as considered in these chapters.

Taking for granted that the considerations in this chapter are correct, deductions may be made that will run counter to the opinions of those who favor the contraction of matter as the source of energy emanating from the sun.

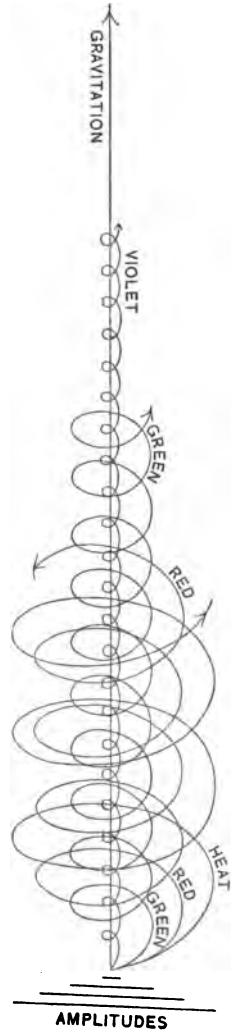


FIGURE IX.—RELATIONS OF THE DIFFERENT FORMS OF HEAT AND LIGHT ENERGY.

The deductions are as follows: The universe will never become any hotter or any colder than it now is. Every celestial body will become hotter as its mass and density product increases until a limit is reached, when additional matter will be reduced to its ultimate analysis—the ether particle in energy form. The sun may be said to be entering that stage of its existence. Thus solar systems may grow, arrive to the limits or maturity, disintegrate and dissipate matter into space and form systems anew. We may say that our solar system has not reached the stage of maturity. Its members are severally growing in the grand cycle of ages. Every gathered meteoric particle silently and positively attests to the fact.

In contradistinction to the above, the following opinions from reputed writers may be considered: "Sir William Thomson considers that there is a tendency in the present state of the known world towards the conversion of all physical energy into the sole form of heat. Heat, moreover, tends to diffuse itself uniformly by conduction and radiation until all matter shall have the same temperature. There is consequently, so far as we understand the present condition of the universe, a tendency towards a state in which all physical energy will be in the state of heat, and that heat so diffused that all matter will be at the same temperature. So that there will be an end of all physical phenomena. Vast as this speculation may seem, it appears to be soundly based on experimental data and to truly represent the present condition of the universe as we know it."—Ganot's Physics.

"Some astronomers contend that the sun is continually radiating its heat away with boundless prodigality,

it is reasonable to suppose that the stars, which are but distant suns, are doing likewise. We know of no way in which this expenditure is to be repaid. We can look forward to the time when the sun will become a cold cinder, feeling its way by starlight through the darkness of infinite space. But will there be starlight then? Many of the stars are larger and hotter than the sun, and, though much diminished in radiance, will yet be able to shed a kindly, though feeble, light upon his pathway. But the time will come when even the brightest and hottest, having radiated its heat away, will roll a cold corse among its dead compeers. Such is the gloomy teaching of our philosophy."—Howe's Astronomy.

"Accepting the theory that the sun's heat is maintained by a gradual shrinking of his volume, he must have been vastly larger in the remote past, and he will become very much reduced in size in the distant future. If we assume the rate of contraction to remain unchanged through indefinite ages, it is possible to calculate that the earth has been receiving heat from the sun about 20,000,000 years in the past. Also that in the next 5,000,000 years additionally, he might continue to emit heat sufficient to maintain certain types of life on our earth. A vast period of 30,000,000 to 40,000,000 years then, may be regarded as likely the duration or life period of the solar system from origin to the end. Their heat all lost by radiation, the sun and his family of planets might continue their journey through interstellar space as inert matter for additional and indefinite millions of years."—Todd's New Astronomy.

And to extend the deductions of this chapter, as for

our small terrestrial sphere, its internal heat need not be considered a residue from a spherical accumulation of fiery gas. Its center need not be a hot place. Its surface is radiating energy or modified gravity lines away to space continually. Its exterior shells for a few hundred miles in depth, grind and crunch upon one another in the kneading process of restoring the equilibrium disturbed by erosion and the tides. This grand operation is one of the modes for changing gravity lines into energy lines. The dissipation of energy will follow along lines of least resistance through the outer shells. We commonly term these places of exit, volcanoes. As the mass and density product increases, terrestrial darkness will disappear, when this earth scintillant with volcanic fires, will become a grander modifier of gravity lines, an incipient sun. Whether this hot terrestrial era will be 30,000,000 or 3,000,000,000 centuries hence may be determined by calculating the yearly accumulation of meteoric dust. Yet before that time will have arrived, small transient man will experience many cataclysmic vicissitudes. And as it has been in the past, so in the future, man's much vaunted higher civilizations will many times successively disappear and reappear only that more of this eternal energy may become dissipated into space. Telescopes, dynamos and thirteen-inch guns are not new to the sun nor will they cease to be rediscovered or invented again and again.

CHAPTER VI.

ETHEREAL AND MOLECULAR ORDERS OF NOTIONS.

SYMBOLS $\frac{A}{\odot^4}$, $\frac{A}{\odot^3}$ RESPECTIVELY.

Units, the ether particle and the molecule respectively.
Limits, the molecule and the cell respectively.

To consider the subject of gross matter in its ultimate analysis compels the mind to deal with speculations of the ethereal and the molecular orders of notions. Ether as an universal substance may be conceived as made of moving particles in straight line motion. Should a particle of ether have a certain velocity within a definite sphere of action such that, to finite considerations, the particle would be anywhere at any time, reason would be as well satisfied as to the solidity of the sphere as if it contained a number of stationary particles sufficient to fill the same volume to the required density. The question as to the density of gross matter may be as much a consideration of the motion of the ether particle as it is of the number of them within a definite space and motionless. Consequently, the perpetuity of gross matter will demand that the absolute motion of the ether particle in its mechanical forms cannot be altered or destroyed and that it retains its absolute velocity forever.

Should any particle of ether proceed in any other path than a straight line and should it recur in its travel through a point in space, the recurrence may be termed a manifestation of gross matter in its simplest form. And should it describe an orbit with a certain frequency and

possess a certain form passivity, the mechanical form may be termed an atom. The diameter of the orbit of the revolving atomic particle compared with the diameter of the particle may be of an infinite ratio, similarly as the diameter of the solar system infinitely compares with the diameter of the earth. It is obvious that if the diameter of the atomic orbit be decreased that the angular velocity will be increased and that a ring of presence would be formed having a density varying inversely with the diameter of the orbit. These orbital relations or rings can assume any plane of revolution whatever. A collection of them having the necessary proximity would form a mass of gross matter having the parts mutually joined together by the interlocking and inter-revolving atomic orbits. This aggregation of the ethereal orbits may be termed a molecule. The construction and properties of gross matter would then vary according to the number and diameters of the atomic orbits and the form and the symmetry in the arrangements of the molecules within certain space limits. Gross matter may be defined as the mechanical arrangements of the particles of ether in a system of orbital motions. A mass may represent an amount of motion and the denser the mass the greater the number of passive orbital forms which any volume contains. The properties of gross matter may be determined by the manner in which it is affected by lines of energy and lines of gravity. The manner is determined by the senses and the conceptions are termed the properties of matter.

The particle of ether cannot lose its identity. It cannot be predicated any more than it is the ultimate analysis of gross matter and that its motion is perpetual. It can-

not to be checked in its velocity because there is nothing smaller to impede it in its motion. It may be diverted in direction of motion but the absolute motion will continue forever. Hence under this consideration matter cannot be annihilated. When gross matter is moved by energy against gravity, a certain amount of work is said to have been done, or a certain amount of energy to have been dissipated. Dissipating energy is the opposite to engaging it. Engaging energy may be termed the process of causing a particle of ether to change its spiral or helical translation into an orbital motion around or among a collection of molecules. The revolving presence of the particle of ether may bind the molecules together into a definite system similarly to winding or wrapping a string in many directions about a sectional sphere of irregular parts. Not only will it tend to bind the molecules together but the mass will tend to move in direction of the resultant of the engaged revolving particles.

Should these orbits of energy enclose a mass of molecules as independent bodies and not interlock with the wrappings of energy orbits of other molecules, the condition for the simplest form of life is manifest. Should energy particles insinuate themselves into the gross matter to such an extent that the atomic orbits are interfered with in their cycles of passive interrelationships, the molecular constructions may become separated to such an extent that the properties of a liquid are conceived. And should the energy particles insinuate themselves in sufficient number that no cycles of interlocked atomic orbits whatever can be ascertained, the properties of a gas will be conceived. The tension of the gas will depend upon

the number of ether orbits per volume separating the molecular constructions. Hence the number of ether particles in energy or orbital motions per volume, determine the absolute temperature of any mass. Without the presence of gross matter no temperature can be recorded. Adding ethereal motion to a mass is causing it to become heated. Abstracting heat is the same as abstracting ethereal motion. Gases are the only means by which the motions of the ether particles may be manipulated without the special preparation of the molecular construction of gross matter. Any gas compressor may be conceived as a molecular strainer, sieve or ethereal press whereby the ethereal orbits may be separated from between the molecules of the gas by being pushed through the walls of the compressor. The molecules of the gas being too gross to escape from beneath the pressure are retained behind. When the ethereal particles begin to exude, the walls of the compressor are said to become heated. The rate of their outward flow determines the temperature of the surface. Compressed gas represents a vacuum in relative terms respecting the number of energy orbits in an initial volume which is taken as a standard. Liquid air represents a volume of atmosphere with many of its energy orbits abstracted. Relieving the pressure of the compressor permits the orbits to enter again from the surrounding space. An equilibrium of energy pressure indicates an identity of temperatures.

Evaporation may be considered a difference between the pressures of energy and gravity on gross matter. The gross matter in consideration is the different states of

water. On account of the orbits of energy separating the molecules of water by their revolutions among them, the atmosphere per volume offers more resistance to the lines of energy in passing through than gravity and consequently the molecules of the air and vapor are pushed upwards by the surrounding atmosphere where evaporation is not so intense. Thus the vapor is forced upward to those regions where the energy pressure is not so intense. There the energy particles or wrappings become dissipated into the space less occupied by them. The molecules of vapor then offer such relative resistance to gravity lines that they are pushed to the earth again. This energy dissipated represents the amount of energy that may be manipulated again by the water wheel and dynamo. Now where does this second installment of energy of the dynamo come from? It is safe to say that the dynamo does not manufacture it from itself as a spider may produce a web. Neither is the product caused by friction of its parts nor an enormous growth of a neucleated electrification found in its parts and caused to continually augment by being gyrated a certain number of times per second by some attached motive power. Something cannot come from nothing. To make two gallons of liquid air from the vacuum of energy to be found in one is as easy as forming a continuous line of energy by a dynamo from nothing. Both are impossible problems and each is a form of the perpetual motion puzzle. The field and armature of the dynamo are but conditions or adjustments of gross matter by which lines of gravity may be manipulated in definite directions.

We know by the weight of an object that the gravity

lines interfere with the molecular constructions of gross matter. Why may not the molecular constructions of gross matter be so arranged that gravity lines may be manipulated in any desired direction? Is the molecular construction not specifically arranged to permit the passage of the gravity particles through it when it is magnetized? Then why not term magnetization the arrangement of the molecular construction of gross matter in such form that it will permit the passage of the gravity lines in one direction with less resistance than in another? Being able to make this adjustment enables man to manipulate gravity lines by the aid of the dynamo and the motor.

The amount of energy dissipated by the vapor in the upper regions may be realized in part by capturing the water as it descends over some declivity impelled by the lines of gravity. The water meets resistance to its onward flow toward the sea level in the turbine attached to some dynamo. The former is worked by the floods of water which in turn works the dynamo against the homogeneous flood of gravity lines surrounding it. The gravity lines finding less resistance in a certain direction to their motion, or stress, take it as a mathematical or natural necessity. A vacuum of gravity lines, comparatively speaking, is formed on one side of the circuit by the gyration of the dynamo and a pressure of them on the opposite one causes a movement of the ether particles along a specified path having a specific resistance. The gravity lines are modified into energy orbits by meeting some resistance to their onward flow. This manifestation of the gravity lines in the resisting medium, is termed electricity, heat and light. The motor bears the same rela-

tion to the flow of gravity lines in the circuit that the turbine bears to the current of water. The transferrence of the gravity lines into energy lines by the means of the dynamo acting under the motive power of the steam engine or turbine against a resistance, may be similar to the action of the sun in modifying its intercepted gravity lines into energy lines. If the ether particle can be manipulated by pieces of appartus in wireless telegraphy in definite directions, the dynamo need not be more mysterious.

A cycle of transformation of the motion of the ether particle may be stated as follows: The sun modfiies a gravity line into an energy line and dissipates it into space. It is intercepted by the earth and engaged by vegetation in an orbital relation which may be termed an energy wrapping or carbon atom relation. It is permitted to unwrap or "oxidize" in a furnace under a boiler where it is pressed through the iron shell into the water. It revolves among the molecules of water and tends to separate them. The number of orbits per volume determines the tension or the temperature or the pressure of the vapor. This pressure existing between the molecules is manipulated by the piston of an engine which gives motion to other pieces of machinery for meeting resistance of some form in the many avocations of man. To the dynamo, to manipulate gravity lines; to the pile driver, to work against gravity lines; to turn wheels, that gross motion in translation or force may be attained, as the steamship, the train, the hoist and every other form of industrial activity known to man. In fine, the cosmic principle is being demonstrated in its simplest

terms by these activities or energy manipulations. After the energy particle has been released from its restricted bounds, it is found to enter volumes where the energy pressure is of less tension and when if not captured, it escapes to the realms of infinite space where it proceeds on another cycle of infinite relations preserving the velocity it had before encountering some dynamo or sun.

Chemical affinity may be termed the action of gravity lines against the molecular constructions of gross matter at infinitesimal distances. The mathematical formations of gross matter in its molecular constructions may render certain formations of the ether particle in its orbital relations more universal than others. As the triangle, square, pentagon and hexagon have specific relations that are universal and eternal so may there be forms of movement of the ether particle that are universal and eternal. Some forms will engage the energy lines from the sun in a more economical manner than others—carbon for instance. Some forms will fit mechanically together in better relations than others when the energy wrappings are removed. The fitting together of these mechanical relations—combinations in proportions suitable to their forms—may be termed the chemism of the operation. It may not be far wrong to say that when these operations at infinitesimal distances can be conceived in their true relations, that the science of chemistry will be considered strictly a mathematical interpretation of world relations in the molecular order of notions. Then atomic weights, valences, combining weights, proportions and structural formulae will find their cause for being, in the absolute motion of the ether particle in its myriad of mechanical forms.

Motion is an attribute of the ether particle and is necessarily a fundamental notion. Force is derivative term denoting the gross motion which lines of energy or gravity impart to gross matter. The motion of the ether particle is absolute. That of gross matter is a relative term. All matter may be reduced to a straight line motion by rectifying the different factoral movements of the ethereal particles that compose it. As for the ether particle and its absolute motion neither can be destroyed. These provisions in the theory herein entertained must be sustained to satisfy the doctrine of the perpetuity of matter and the conservation of energy.

To a mind situated in the order of notions A ∞^3, the solar system A ∞ bears the same relation to it that the cell in the biological order of notions $\frac{A}{\infty^2}$ bears to the mind located in the geographic order of notions A. Then as a deduction from the general argument, it is obvious that the summation of all the ether particles in the visible universe and devoid of motion would not form a mass of gross matter that would be conceivable by man. Hence gross matter is as dependant on the absolute velocity of the ether particle as it is on the mass of the ether particle itself, to possess the property of occupying space. Any unit of measurement augmented to an infinite summation in any order of notions is infinitesimally small if considered in the order of notions next higher in the series.

To perceive of God, if such be possible, will necessitate the mind to consider the orders of notions possible above and below those assigned for the finite considera-

tion of man. And as this range of orders may be carried to an infinite extent, the human mind must positively perceive that God is an infinite conception of the highest order and that man's knowledge of the world must ever remain in relative terms.

The character A_{∞}, indicates an infinite relation of the first order. $\frac{A}{\infty}$ indicates an infinitesimal relation of the first order. The mind of this age is changing its point of view in considering phenomena from the relations of $\frac{A}{\infty}$ to A. From this latter position it is safe to say that mortal man will never change for a higher one. Yet, some future era will find him again struggling with the interpretation of phenomena using as a unit of measurement the dimensions of man, $\frac{A.}{\infty}$ the unit of the ancient Hebrew, Greek and Roman age for considering world relations.

CHAPTER VII.

THE BIOLOGICAL ORDER OF NOTIONS.

SYMBOL $\frac{A.}{\sigma^2}$

Unit, the cell. *Limit, the man.*

The subject of life and organic constructions are in ultimate analysis, considerations of infinitesimal relations. It is obvious that a consideration of life and the different forms of matter in which it is found will compel the mind to deal with the ether particle and its motion. That mundane life is energy from the sun cannot be denied. For by visiting those portions of the earth where the shadow covers the surface for a great portion of the year for consecutive days, it is found that gross life becomes scarce and comparatively nothing but passive gross matter is manifest. By augmenting this idea, by interposing some body between the earth and sun such that the sun's energy shall be cut off, it is obvious that in time, gross life would not exist on the earth's surface. Yet the absolute temperature of the earth need not necessarily diminish on account of the earth's mass and density that would afford resistance to the lines of gravity tending to pass through it.

From previous deductions, the motion of the ether particle may be considered the basis of all life. And consequently life forms may exist elsewhere as it is on the terrestrial sphere if the same conditions be fulfilled. That is, the planet shall have the same mass and density product and receive the same energy pressure from its

luminary and fulfill other requirements that may be found in the geographic order of notions.

The forms of life may be infinite in number and variety. The present number existing does not express all that might have been or may yet become. The largest form today does not at all mean that no larger has existed. The manipulation and the dissipation of energy have compelled the forms to suit their environment. A race of giants fifteen feet high or a race of pygmies two feet in stature is not an impossibility. The only reason that such is not the case is that the most economical manipulation of energy combined with the environment would not permit a perpetuation of the species.

When the spirals or helices of energy become engaged with the molecular constructions of gross matter, the phenomena may be termed a manifestation of gross life. A recurrence of a molecular construction through a position in space and influencing other molecules to similar actions may be termed the simplest form of organic life. This may be termed a cell. The complexity of the molecular constructions combined with the complexity of their motions signify the comparative advancement in the scale of life. All forms of life may be classed under two heads as respecting their prime functions in the manipulation of energy which the earth receives from the sun.

All the vegetable kingdom may be considered organic arrangements for the purpose of engaging energy from the sun with the molecular construction of gross matter as a chief function.

All forms of the animal kingdom may be considered

organic arrangements for the purpose of dissipating the engaged energy as a chief function. Energy has been engaged as it were by all forms of vegetable life and the present form or state of man is its egress of least resistance back to space, or the primordial state of the gravity particle. The receptacle vegetation, the organic derivative of the first order, may be likened unto a great reservoir receiving a perpetual stream of energy from the sun. The animal creation, derivative of the second order, may be likened to so many openings having varying resistances to the pressure or outward flow. Under certain pressures certain rates of flow will be attained. And when the pressure reaches a certain maximum or limit which is indicated by a critical temperature, the present form of dissipation by animal function will give way to a more rapid and universal form of dissipation of energy, that of oxidation so called, of the simplest form. And consequently should the pressure of energy from the sun increase, the emissions would be compelled to augment in their dissipation. The augmentation in power to dissipate would be classed as a higher evolution of the dissipators.

Animal and vegetable creations are evolutions or derivatives from the simplest fundamentals. The survival of the fittest are but the most economical manipulators of energy of any class of animals at the time of consideration. Man has his present form or development because the greatest amount of energy finds the least resistance in its dissipation back to space through his form than through that of any other. His position in space in respect to form represents the maxima advantages for the manipulation of energy with the mini-

ma restraints. In respect to space relations for the dissipation and the manipulation of energy, man has a mathematical position and form. And whether best or not more manipulation of energy will tell. The most powerful animal is that which can dissipate the most energy and the superior of animals is that which can manipulate the most energy. Hence man is the superior of the animal kingdom. The most powerful man is he who can manipulate the most energy.

"Man is more powerful than any other animal because
He thinks and feels beyond his humble sphere.
And more than drinks from the fount of eternal power.
With energy and force which the sphere surrounds
He shrivels space and discounts time.
Every power of every Homer's god he knows, and more
The sun and moon he weighs.
His ken outwits the bee, the maple sweet,
The cane and lowing kine;
Odd plants and trees, their peculiar charms
He finds in oil and corn.
A hawser in a spider's strand he sees,
His skill outspins the humble worm.
The hardest mountain's heart is pierced by him
And the highest hoary head of them has seen his form.
The lightning's bolt, he leads to harmless ways,
Or seeks its home among the driving clouds.
The deepest ocean feels his searching line,
Its angry crests, he rides with cheery mien.
The distant storm's ungracious visit, knows
And has its havoc timely heralded to him.
Yet more;— the keys to nature's archives he would hold,
To know;— his past, a plotted dream
That endless time from him would screen.
His life;— a leading tone in cosmic song.
His end;— another theme in grander form begun."

—*Seabe.*

Mere reproduction and the simple dissipation of energy are absolute characteristics of the brute creation. Intelligence, the real distinction existing between the different species of human kind, is measured only in terms of energy manipulation. True, other methods may be assigned for making the distinction but none other is capable of any quantitative determination. Should any form of life become capable of manipulating energy comparable with man, then will that form be considered of human kind.

In the vegetable world, the engagement of energy is the prime consideration. That "plants, like animals, struggle with one another to preserve their respective individualities" is but an apparition. Those that can engage the most energy the most economically are those that predominate in any habitat. Plants are passive. Animals are active. From the sand-bur to the most preferred cereal or the proudest cedar of Lebanon, no plant is beneficial to the earth or mankind if it does not engage energy from the sun. Plants dissipate energy in their industries as well as animals but their engagement of it exceeds their dissipation.

It is obvious that as civilization advances that the grosser forms of animal life will become extinct. The elephant, tiger, lion, hippopotamus and rhinoceros in five hundred years will be no more. As a deduction from an energy basis in biology, the presence of mammoth forms of animal life of preceding ages argues that the great manipulator of energy, man, had not developed to any considerable extent either in numbers or power and that his knowledge of energy manipulation was that of

the common dissipator. *The greatest thing in this world is energy and the greatest thing man can do is to manipulate it.*

CHAPTER VIII.

THE SUBJECTIVE ORDER OF NOTIONS.

SYMBOL $\frac{A.}{\infty}$

Unit, the man. *Limit, the earth.*

From the fundamental actions in the manipulation of energy are derived the activities of man in their infinite variety—activities from the simplest home relation to the most highly derived considerations of jurisprudence and international law. The misunderstandings of doctrinaires are but varied interpretations concerning man's relations to the cosmic principle. Political parties, factions, creeds, societies and combines of whatever description have their excuse for existence by promising by their doctrines a more plentiful manipulation of energy for the benefit of man than can otherwise be attained. Every wish, motive, ambition and passion of man are subservient to the grand fundamental requirement of nature, energy shall be dissipated and that abundantly. This is the sublime function. Nothing is higher but He who wills it.

To say that the sole business of man is to manipulate energy to the greatest possible extent and in the most economical manner is reducing the problem of human life to an apparently simple affair. What he can eat and wear out and cause other people to eat and wear out the most plentifully and economically measures his influence for good in this world. A place of responsibility means a center for the manipulation of energy. A man who fills this position is termed a successful man. Hence the

most successful man is he who causes the most energy to be manipulated for the benefit of mankind the most economically.

It matters not what profession or trade one may choose to follow, and whether he be peasant or potentate, the manipulation of energy is his inspiring motive. Happiness is the consciousness of being in a condition and position for a successful manipulation of energy. Hard times are measured by the comparative amounts of energy dissipated. Prosperity means a plentiful dissipation by the multitude in an economical manner. Advance in civilization is measured by the comparative capacities of a race for manipulating energy in an economical manner. The capacity to do so necessarily depends upon the quantity and the quality of the instruments used to manipulate energy from the sun. Great monopolies, trusts and aggregations of wealth in instruments for the manipulation of energy are indices of a true civilization where they become agents for the welfare of the whole people. Great lines of commerce on the high seas, the network of railways, telegraph, telephone, postal and money systems and great municipalities are engines or instruments by which a great and powerful government or people may manipulate energy to its full capacity. Governments are instituted among men that a more successful manipulation of energy may be attained. And as for the right and just privilege to manipulate energy "all men are created equal." The spirit of altruism or humanity endeavors to make it possible for all mankind to manipulate as much energy as possible. The cause of all wars in the ultimate analysis is the desire to remove the difficulty. The supreme com-

mand is that energy shall be dissipated and that abundantly. The tyrant dictates as to the manner and the amount of manipulation and the oppressed are those who feel the ways of the tyrant.

The amount of energy manipulated by the busy and powerful peoples cannot be conceived. Statistics of the world are for this specific purpose but they hardly give a hint of the majestic proportions. The amount of dissipation bears an infinite relation to the simple conceptions of man. The streams of humanity on State street, Broadway and the Strand are but mites of the dissipating world, three corpuscles only in the living race. Yet all are striving with one unconscious aim. One zeal, one inspiring motive, one instinct compels all to the same destiny. The same trait would be found on any other habitable sphere in the universe. The desire to dissipate energy is the desire to live. Perfect dissipation and manipulation is perfect joy and heaven's highest reward can be no more. The perpetual manipulation of energy is immortality.

The activities of the human race classified in terms of the most fundamental social factors may be arranged into such form that their inter-relations may be rationally conceived. The home, the church, the state, the school and the vocation are inclusive of all man's activities in the manipulation of energy.

The home is the most economical instrument of a civilized society for rearing manipulators of energy.

The school is an instrument of organized society for preparing successful manipulators of energy.

The church is an indication that the manipulators recognize a common brotherhood of all mankind and a Creator of all world relations as a Fatherhood of all.

The state is an instrument inclusive of a division of labor by which the most energy may be manipulated by the governed as a whole the most economically.

The vocation is the manner in which any one may choose to manipulate energy. That vocation is essential which, by its pursuit, other dissipators may be aided in their manipulation of energy.

These basic activities of the human race thus defined may be termed Les Cinqs Magnifiques of the subjective order of notions. Which of the five is the most important can be ascertained only by measuring its potency in terms of energy manipulation.

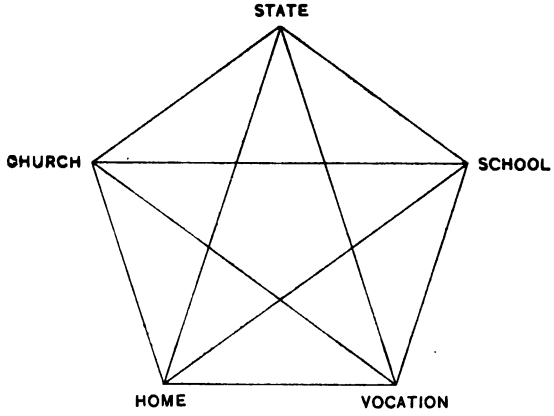


FIGURE X.—LES CINQS MAGNIFIQUES.

Doctrinaires may change the arrangement of the social factors to relations suitable to their respective points of view. The educationist might argue that the welfare and stability of all society rest on the learning of the dissipators.

The theologian would none the less contend that inspirations from on high would furnish rules and regu-

lations fit for the most successful manipulation of energy. The economist would also urge that the sustenance of the dissipator was more fundamental and necessary than the more highly derived factors of les cinqs magnifiques. And the sociologist would say that the organic laws for the most perfect continuation and development of the race for the sublime function are the properest consideration. In fact, the doctrines of none of them alone are sufficiently broad to form a basis for the progress of the race. The combination may be turned into various permutations. The form of society can never reach a perfected state when the church or state or school is made the basis of its organization. These factors are derivatives from the home and the vocation and must be considered as secondary factors in the organization and welfare of civilized society. Power, learning, industry, love and inspiration are factors of a progressive race when working in proper co-ordination. History records much sad experience of human kind trying to satisfy surging energy on a basis of power and inspiration. The two centuries now passing have experienced a change of base towards that of power and learning, yet the strife and turmoil and unrest of dissatisfied man as exhibited between the state and industry shows plainly that power and learning are not the bases for that form of society which will offer him the most economical means for manipulating energy. The state must not have too much authority delegated unto it. The church must not run too strong with the wills of men for fear of "perfection in the flesh." And learning can be but relative at best.

Since the engagement of energy is as essential a world relation as the dissipating of it, the agricultural re-

sources of a country are fundamental factors of a great and powerful people. Agricultural vocations necessarily become to a civilized race its most essential factors for progress but these alone do not make it the most powerful. To be able to manipulate the most energy the most economically in the most varied forms for the benefit of the human race, marks the efficiency and worth of any people. There can be no real independent personages in a civilized country. Every one must work much of his time for some one else. This is the most rapid method for the dissipation of energy that man can devise. To do otherwise disobeys the mandates of the cosmic principle. No one can live for himself alone. He must co-operate. The lower animals understand this. The rulers of the earth in the coming centuries will not be kings and emperors selected from a privileged line of ancestry claiming "divine sanction" but rather from those who claim to be most conversant with the doctrine of the rightful manipulation of energy. A few practical illustrations will suffice to show the importance of energy manipulation in the common affairs of life.

TABLE X.

NUMBER OF FOOT-TONS OF ENERGY IN ONE POUND OF EDIBLE PORTION OF COMMON FOODS AND SUPPLIES.

Articles.	Foot-Tons.	Articles.	Foot-Tons.
Sirloin	1,841	Cheese	3,157
Rump	2,739	Butterine	5,515
Top of sirloin	3,195	Potatoes	573
Liver	1,016	Sweet potatoes	810
Heart	2,157	Red beets	297
Kidney fat	6,135	Turnips	272
Veal	1,208	Carrots	313
Sheep, hind quarter	2,256	Onions	343

TABLE X.—*Continued.*

Articles.	Foot-Tons.	Articles.	Foot-Tons.
Lamb	1,766	Pumpkins	168
Smoked ham	2,998	Cucumber	105
Salt pork	5,370	Cabbage	236
Chicken	826	Lettuce	183
Chicken gizzard	795	Tomatoes	120
Chicken liver	971	Green peas	612
Turkey	1,239	Lima beans	532
Turkey gizzard	1,552	Canned corn	717
Turkey liver	1,001	Apples	489
Eggs	1,101	Cherries	402
Lake trout	1,254	Cranberries	535
Black bass	688	Blackberries	374
Canned salmon	1,035	Grapes, Catawba	765
Salt mackerel	1,365	Lemons	321
Oysters	351	Banana	979
Clams	435	Watermelon	245
Milk	496	Muskmelon	634
Butter	5,530	Strawberry	265
Rice	2,463	Molasses	2,080
Oat meal	2,784	Alcohol	4,962
Corn meal	2,516	Kerosene	7,680
Rye flour	2,485	Coal, hard	5,443
Wheat flour	2,516	Oak	2,773
Graham flour	2,485	Wheat	2,367
Whole wheat flour	2,509	Corn	2,397
Buckwheat flour	2,455	Cotton seed	2,448
Graham bread	1,873	Oats	1,907
Wheat bread	1,946	White clover	1,609
Starch	2,784	Red clover	1,300
Sugar, granulated	2,784	Timothy	1,417

TABLE XI.

ENERGY IN FOOT-TONS DISSIPATED PER DAY BY ANIMALS AT REST AND WORKING. WEIGHT OF MAN—150 POUNDS; WOMAN—120 POUNDS; BRUTES—PER 1,000 POUNDS.

Animal.	Foot-Tons.
Child 6 to 15 years of age	3,120
Woman, aged	2,845

TABLE XI.—*Continued.*

Animals	Foot-Tons.
Man, aged	3,785
Woman at light work, Foreign	3,810
Woman at light work, American	4,100
Man at light work, Foreign	4,460
Man at light work, American	5,350
Man at hard work, Foreign	5,105
Man at hard work, American	6,885
Oxen, in stall	25,726
Sheep, in stall	37,750
Oxen at moderate work	36,720
Oxen at hard work	47,622
Horses, moderate work	40,868
Horses, hard work	51,267
Subsistence diet, man	2,710
Sedentary diet, man	2,880
Active life, man	4,810

TABLE XII.

ENGAGEMENT OF ENERGY FROM THE SUN IN FOOT-TONS.

Energy in foot-tons in one bushel of wheat	142,020
Energy in foot-tons in one bushel of corn	134,234
Energy in foot-tons in 25 bushels of wheat, one acre	3,550,500
Energy in foot-tons in 65 bushels of corn, one acre	8,725,080
Visible surplus, wheat in the world, bushels, October 20, 1899	400,000,000
Visible demand, wheat in the world, bushels, October 20, 1899	389,000.000
Market price, cash wheat, Chicago, October 20, 1899	70 cts.
Market price, cash corn, Chicago, October 20, 1899	30 cts.
Energy in foot-tons, wheat, for one cent, Chicago, October 20, 1899	2,028
Energy in foot-tons, corn, for one cent, Chicago October 20, 1899	4,474
Energy in foot-tons in one standard heat-hour, per square foot	263
Energy in foot-tons, in one year, latitude 40, per square foot	446,837
Value one square foot sunshine, one year, latitude 40, in 30 cent corn	$1.00

Tables X and XI are deductions from bulletins Nos. 21 and 22 of the U. S. Department of Agriculture and Landolt and Bornstein's physical and chemical tables. In order that the contents of these tables may have a particular bearing with the reader it is to be conceived that "foot-tons" are not to be perceived simply as expressions in printer's ink. They have a particular bearing to every individual who would think correctly of his world relations. Should one walk to the summit of Pike's Peak along the cog railway, distance nine and one-half miles, with an ascent of 10,000 feet, the dissipation of energy in the muscular effort would be quite appreciable and capable of gross measurement. A 150-pound man would dissipate 1,500,000 foot-pounds or 750 foot-tons of energy in the ascent or about the energy contained in one-fourth of a pound of good sirloin, or two pounds of gunpowder.

In the practical affairs of life, energy manipulation may be considered in larger units of measurement. A lady who is supposed to be the richest woman in the world, owns the greatest important coal deposits on the western coast of South America. She controls energy in the lump.

The greatest organization of wealth on the earth, the Standard Oil Company, controls energy in liquid form. Oil is more valuable than coal because the energy contained is more easily dissipated and manipulated.

The greatest electric plant on earth, the Niagara Falls, is taking advantage of matter that has dissipated energy. The force is utilized in turning a dynamo to modify gravity lines into energy lines—electricity, heat and light.

The rich prairies of the Mississippi valley are natural

conditions or pieces of apparatus for the engagement of energy in carbon form.

Great outgoing ocean currents and constant winds from the equatorial regions toward the poles are evidences of matter having engaged energy from the sun in orbital relations. The incoming winds and currents from the poles are evidences of matter having dissipated this energy into space. These combined forces form the greatest system of energy manipulation on the terrestrial sphere.

Great trunk lines of railway systems combined into one great solidarity is simply an adaptation of circumstances to remove resistances in a successful manipulation of energy.

A great city is a center of energy manipulation.

Iron and copper mines are valuable only in that instruments may be fashioned from their ores by which energy may be more easily manipulated.

Civilized money is but a general representative of energy, a picture composite. It has no value in itself. It is of no worth if not receivable for energy in any of its manipulated forms. The unit of measurement for all material values is the unit of energy which may be expressed in foot-tons. Intrinsic values are determined by the number of foot-tons of energy that any commodity possesses. Acquired values are determined by the advantages commodities possess for the manipulation of energy. Real price is determined by the amount of energy in foot-tons that is dissipated to acquire any desired commodity. Acquired price may be less or greater than the real price. A civilized dollar is another form of expression for saying

a certain number of foot-tons of energy. Gold and silver become less and less worthy as money metals as man progresses in civilization. They fall in price as civilization advances, as man dissipates less energy to obtain them than formerly. The space element has much to do with the money question and since space and energy manipulations have relatively changed in a generation, present man finds himself entering into new relationships with them such that the experiences of his ancestors do not wholly prepare him to meet the emergencies thrust upon him. However, the difficulty will be easily surmounted when man sufficiently acquaints himself with the science of manipulating energy rightfully. The day is not far distant when this general representative of values will be regulated in terms of the most general industrial security. That security will be national taxes. Then the vitality and worth of civilized money will depend upon the power and ability of government to lay on and to collect taxes. Taxes are but a certain amount of energy appropriated by a people to maintain an economical form of government. That form of government will possess the greatest vitality and stability that enables its people to manipulate the most energy the most economically. The first great requisite of a great government is to possess the necessary energy to manipulate. The second, is that every individual shall have an equal opportunity to manipulate energy. The third, is that the subjects shall have the intelligence to manipulate energy economically.

The great Spanish orator and statesman, Castelar, had this to say concerning a people noted for their manipulation of energy in its most varied forms: "I know how

hard it is for Spanish temperament to yield to adverse fate and implacable destiny. We are a strong willed race. We have so often accomplished the impossible that we came to believe that everthing was within the reach of our efforts. Alone through a strife of seven centuries, we fought Mohammed Asia and Africa from Mecca to the Pillars of Hercules. Alone we discovered a new world and appropriated the larger part of it. We counted not the number of our foes, either in our wars against the eastern Moor or the western Napoleon. Under the spell of such memories we did not recognize the changed conditions and circumstances. Like feudal warriors who disregarded the invention of gunpowder but still relied for personal defense and aggressive battle upon the armor, the lance, the sword and their own strong arms, we trusted in the late arbitrament of war merely in our personal bravery, and on that bravery to resist successfully if not to conquer the greatest industrial and mechanical people on the earth; a people who, if they did not discover steam power, have made use of it as no other nation has; who, if they did not discover electricity, have nevertheless surpassed all others in their wonderful application of it. With respect to effective power, our adversaries excelled us on every occasion. With respect to mechanical equipment and material resources by which effective power is greatly augmented, we were indescribably inferior. Compare their explosives and ships and guns with those of ours and tell me if it was not a victory of science and industry over tradition and routine. Yet, though reasons for despondency confront us from every side, God forbid that we cast away in our mad desperation the blessings left to us. For by giving substantial encouragement to

them, by interchanging industrial relations for mere diplomacy, by promoting manufacture and agriculture and commerce, the time will come when the plow furrowing our fields, the busy shuttle of our factories, the pick in the depth of our mines and our merchant ships upon the high seas will be to us a glory far greater than all our romantic chivalry of the past." (Adapted translation from the Christian Advocate.) Such are the burning words of a leading European statesman who recognizes the inferiority of his people and their salvation and glory in terms of the possession and the manipulation of energy.

A monarchial form of government implies that the most responsible agents of government are best supplied from particular homes.

A republic implies that the most responsible agents of government are best supplied by selection from the most trustworthy manipulators of energy. The Constitution of the United States may be termed a recipe by which Uncle Sam may manipulate the most energy the most economically. The Declaration of Independence was written from the standpoint that energy was being injudiciously manipulated under foreign agents of government. Thus examples may be cited from every consideration in the affairs of man and each and every one of them may be conceived a derivative from his activities in the manipulation of energy.

The home and the vocation are basic factors in the subjective order of notions. As these two arise in power, influence and perfection, so arise the church, school and state. The limits and the obligations of the home, church, school and state are fairly well outlined and understood

by the normal mind. The labor of the twentieth century will determine the just rights of the vocation. And future historians will have well recorded when they say that *man was led out of the darkness of industrial strife of the nineteenth century by acquainting himself with the doctrine for the rightful manipulation of energy, the mandates of the cosmic principle.*

The doctrine of lyddite shells and dumdum bullets for the welfare of mankind will then have done.

CHAPTER IX.

UNITS AND LIMITS.

There are limiting conditions to which every measuring unit may be applied in the interpretation of phenomena. The inch, the yard, the mile, the earth, the radius vector, the ward, the city, the county, the state, the nation, the cell, the man, the ethereal particle, the molecule, the visible universe, the orders of notions, the pound, the foot-ton, the light-wave and the light-year are some of the units and limits employed by man to determine his world relations. The unit of measurement of one order of notions is used as a limit to measurements in orders of notions below them. The inch may be used as a unit of measurement to certain limits. It is also used as a limit to units of smaller dimensions. The district is a limit to the number of wards while it in turn is a unit of the municipality. An influential man is measured in terms of other men and a nation is measured in influence in terms of its energy manipulators. The different views of the world, though each be rightly deduced, may disagree in most part in being obtained by employing different units of measurements for contrasting notions. Doctrinaires many times differ solely in the magnitude of ratios. The formula of thought is a trite saying of course, but the fact is not realized by many of the world's magisterial enthusiasts who worship too strongly their "idols of the cave."

Every man can personally manipulate a certain amount of energy. By his influence he can cause to be

manipulated many times more. Taking the standpoint that the function of an animal is to dissipate energy and that the amount will vary with the size of the animal, might argue that the elephant would be a more powerful animal than man. That an elephant is stronger than man can not be gainsaid, for the dissipation of energy is greater in the former than in the latter. But as for the manipulation of energy, man far outranks the elephant. Hence man is more powerful and therefore is considered at the head of the terrestrial creation. Intelligence would profit man nothing in his contest with other animals were he not permitted to manipulate energy. To be a dissipator simply would be fulfilling the function of the most ordinary animal. Intelligence may be defined, then, as the knowledge of the best methods for the manipulation of energy. This energy distinction will apply to all peoples. The American Indian is becoming extinct simply because he will not strive to manipulate energy. Could the brown man cause more energy to be manipulated in the interest of humanity than the white man, he would rule Britannia and Columbia, direct commerce and lead the world. The distinction of deference between all peoples lies in their respective abilities for using energy. Thus, to every subjective relation of man, there may be a limit and a unit of measurement applicable to it from the standpoint of energy manipulation.

Since the living earth is taken as a unit of measurement in the geographic order of notions and as a limit to the subjective order, all subjective derivatives and their limits must conform to this great unit and limit. The absolute temperature of the earth is dependant upon its

mass and density product as a limit. The weights of objects on its surface have their limits set by the same colossal unit. Were the earth larger, an object would be pushed against the earth's surface with a greater stress on account of the opposing forces being more nearly removed from the under side. The height of a man has its limits of superior and inferior dimensions. It might be inquired why man does not attain the average height of fifteen feet as well as the present height of five feet nine and one-half inches and weighing one hundred fifty pounds. What is there to hinder him? Would he not become a greater dissipator of energy? Would he not be fulfilling the very requirements of the cosmic principle? Another query also arises in this discussion. What prevents man from developing into a lesser dimension? Why is he not graced with a three or four-foot stature? Would he not find it easier to provide himself with sustenance? And, granting him intelligence, would he not then be able to manipulate energy sufficient to overpower any other animal? Dynamite and nitroglycerine would yet be his. Why should not every derivative be in some other form than it now is? The answer is that man is determined by a superior and an inferior limit and a definite measuring unit. The tree, the giant redwood, has its limit as well as man. Mountain heights have their bounds. In fact, wherever our eyes may turn, the thought may come to us, Why is our environment as it is? What sets the limits? What measures? What rules? When we consider the terrestrial creation, nothing can be thought concerning any fundamental relation without taking motion and matter into account. From these factors of objective

reality, all effects known to man as creation, radiate. To them we must go for answers to our questions.

Man is his average height because, were he larger, the force of gravity would have too much to do with his proportions. He would come to grief too often and many times death by having such great distances to fall should he mistep or stumble. "He" is meant as a general term for the brains of man. The force of gravity in comparative terms would become his constant foe. Should he fall, his injury would be nine times as great as it would be were he but a five-foot man. He would also become a more conspicuous object for other forms of life and the elements to contend with. Hence more liable for continued conflict with all forms of mobile nature. He would also require more food for the maintenance of his organism. In times of distress and famine he would more probably perish where certain physical conditions beyond his control would reduce the supply of food. And when his experiences for several hundred years were compared with those of man of equal intelligence but of smaller growth, it is no doubt obvious that a general complaint would be recorded in his histories as to the unjust preference the world seemed to have for his smaller competitors.

On the other side, the three or four-foot man would have his foes in deep mud and snows, tall weeds and grasses and big rains. He could not contend with these elements so successfully as the larger creations. Other animals more powerful and swift would lessen his chances for getting the all-important energy from the sun. These inferior limits, which are derivatives, have their limits set

by the grand unit of measurement, the moving, living earth. The mud cannot attain an average depth of five feet on the surface of the earth. Nor can the snow and ice exceed a certain depth in the grand cycle of precession. The winds, the weeds and grasses have their limits, too, where man is wont to dwell.

Thus the dimensions of man are dependant upon his surroundings and each of the above are factors of it. The man grows to fit it as the running metal fills the mould. Were he an inhabitant of a larger planet it is safe to say that he would become proportionate to his environment. A larger planet, however, would not be conducive to size on account of the greater weight being added to the body. But if the inferior factors entered into the problem proportionately, the larger man would become the superior animal. Yet, that dimension of man would dominate that would cause the most energy to be manipulated the most economically, whatever the size one might theorize the probable man into.

Much that surrounds man may be termed artificial environment. This is seen in all his creations for the purpose of a more plentiful dissipation of energy. To consider all of them would fill a very large industrial encyclopedia. Taking a very common one, for example, we may consider why a railroad has a standard gauge of four feet eight and one half inches rather than the greater or less dimensions that have been created since the art of railroad building began. Why is it not ten feet wide or two feet from rail to rail? Since the question belongs to the subject of derived environments, we must go to its unit and limit for a basis of consideration. The nearest

world relation to it of course is its creator, man. The track is built to suit the car and the car is made to accommodate the average man. It fits his height. Then the height of the car is the first factor in the solution of the problem. The width comports with the height and the length with both. The three dimensions are in working relations with lines of gravity such that the limits of the strength of materials entering into construction are not transgressed. Then in all constructions of the railroad apparatus thereafter, there is a continuous obedience of man in arranging working relations to suit his height in the great game of manipulating energy.

Houses as well as railroads are made to fit man and the stress of gravitation. Should they become too high, gravitation will crush them down or coast great columns of air down steep barometric grades at fearful rates and topple them over. The great bridges have their limit in span and which are not set by the distance between the banks of the stream but by the limits of strength of the steel entering into the construction. Likewise the massive steamer riding the great billows, when too large for proper adjustment to them, gravitation will break crosswise or twist it into a useless form. And, furthermore, the unit mass of the great leviathan soon passes beyond the control of one mind for perfect management. The psychological unit has its limit also and when the energy to be controlled demands more attention than a single brain can afford, the excess of energy to manipulate will manifest itself a constant foe. Yet in all these considerations, gravity is the great limiting unit to instruments devised by man to manipulate energy. Mountains have

their heights limited by the same world factor. A mountain, like any other form of matter in position above the earth's general surface, represents the amount of energy necessary to place or wear it there.

Not only are there limits to dimensions of objects but there are limits to their rates of motion as well. Nothing can exceed the rate of travel of the ether particle in a line of gravitation. Every organism has its limit in a rate of motion. The horse has a record of a mile pace in one minute and fifty-nine seconds. Whether this is the limit or not can be ascertained by calculating the straining point of the tendons to that extent where the effect of momenta will disrupt the tissues. The most energy dissipated the most economically within the shortest time determines the fastest animal speed. The velocity of the train is also limited; not only by the roughness of the tracks or the degree of the curve or the grade, but by the strength of materials entering into the construction of the wheels. The rotation of the wheels, after a limit has been reached in a proportionate number of gyrations per second, will cause them to burst asunder. Explosives are rated in their strength according to their quickness of action. Powder is a slow explosive. The energy wrappings may not be so easily disengaged in a slow explosive as they are in a composition of nitroglycerine. The time element or the rapidity with which the ether particles disengage themselves in their orbital relations from the molecular constructions of gross matter and the number of them per volume, determine the strength of the explosive. The more ease with which this operation is done determines its more dangerous character. The wind also has its

velocity limited to a certain rate and the crest of the waves of the deep have their limited heights and distances apart. The height of the waves depends upon the strength of the wind. The strength of the wind depends upon the rate of evaporation or the dissipation of energy in some locality. This rate of evaporation is a difference in stress of gravity and energy lines on the molecular construction of vapor. The stress of gravity is limited by the size of the earth. Therefore on a smaller earth there would be smaller waves and tamer winds.

The tides, too, whether of gravity or inertia effect, have their metes and bounds: the former effect, by the masses and densities and distances of the moon and sun from the earth; the latter, by the rate of motion of the moon and earth about their center of moments or gyration. The gravity tide is formed by the surface of the earth being unequally pressed upon by the gravity lines on account of the moon interfering with those gravity lines passing through it. Hence there is a relative vacuum of stress on the earth's surface beneath the moon. The liquid earth is pushed in and upwards by the gravity lines pressing upon it from the remaining directions. Then there will always occur a mound of water or liquid earth between the earth and moon. The "attraction" of the moon is not the cause of this tide.

When the sun and moon are acted upon in conjunction, the gravity tide is increased in volume by the action of a more intense system of unbalanced gravity lines. The sun also obstructs gravity lines from reaching or striking against the earth. And the combined effect of both of them will intensify the vacuum of gravity lines which the impressed liquid sphere will attempt to fill.

The inertia tides are formed in quite a different manner and occur on the opposite side of the earth to those formed by gravity. The earth and moon form a small system of their own. Their interactions through the stress of gravity and their motions of revolution cause a resultant action around a common center. This center lies within the earth about one thousand miles from the surface towards the moon. This action is beautifully illustrated by two girls with clasped hands at play at whirl. The tresses and robes of each are seen to flow to the rear when the fast whirl is made. The action of these appendages is identical to the action of the liquid portions of the earth and moon, if there be such on the moon. The tide is limited by the angular velocity of the earth and moon about the common center. And this angular velocity is limited by the amount of motion or rate of motion that each planet possesses. Thus the tides are limited by the same measuring unit, the moving, living earth. It is seen in the discussion that there are four different tides, two gravity tides and two inertia tides. The gravity tides are caused by the unbalanced gravity lines acting on the liquid earth. The inertia tides are caused by the tendency of matter to follow a straight line motion.

Since man is limited in his stature and his personal manipulation of energy by physical limits, so should his term of life have a physical limit. And it is believed that his comparatively short term of individual presence on earth ought to be reduced to a rational concept. It is obvious that his creations are vulnerable. They are subject to the wear and tear of dissipating energy and apparently go with it. No construction can be made to endure be-

yond a certain limit. "Time" endeth all things. All of mortal history can be but a small ledge jutting from the awful form of the past. From the most hoary of annals, the mind finds no basis from which the inquiry may be answered. Though Methuselah lived nine hundred sixty-nine years before being called unto his fathers, nothing rational is recorded why his descendants should not be blessed with like longevity.

Man is a composite animal. His corpuscular arrangement is made up of an infinite number of small vitalities each having a limited life to run. And since all causes are equal to all effects and no derivative can transcend its fundamental, man from the cell to the grave is an effect representing the summation of a number of causes. This line of development from the first cell to man is represented in his individual development. And since the lower forms were first limited in the length of life by the rhythmic pressures of energy, the pulsations of temperature, the cycles of seasons, all of which are effects from the revolution of the earth having an inclined axis, the question naturally gravitates to the grand fundamentals of the geographic order of notions for solution.

As each cell in the organic world represents a certain amount of mass and motion, any augmentation to it will necessarily mean an additional mass and motion or energy manipulation. This addition takes "time." Each accretion to development adds time to the growth and the decay of the individual animal. Then man's longevity may represent the proportionate time accompaniment in his lineal ascent to the accumulated selected developments of lower forms. The cell may develop into any form what-

ever that will manipulate energy. In fact, it seems that creation is a manifestation of this idea. The forms are infinite in variety because there are an infinite number of directions along which the cell and its progeny may develop. What we know as present forms of life can be but a small part of the possible forms. There can be no possible chance for what is not to exist unless conditions making units and limits change. Therefore, whatever is, suits conditions and their limits best in the dissipation and the manipulation of energy. Then, as a deduction in gross form, the revolution of the earth sets the limits to the endurance of the mortal part of man. As an estimate of him in a rational concept and set to scale in the geographical order of notions, *the dimensions of the earth limit his size, the manipulation of energy determines his form and the revolution of the earth gauges his length of life.*

The derivatives from man's activities are functions also and have their limits in endurance. Governments instituted among men are set to their respective bounds. That form of government will prove of greatest merit that presents authority delegated by the general individual and that form will survive which permits man to manipulate the most energy the most economically. The development of the individual and his maintenance are the basic factors of human society. Nothing will survive that deteriorates their power or function. These factors are the inferior limits of society. The superior limit of society is the amount of energy permissible to manipulate. Hence man on this terrestrial sphere has, as a basis of consideration for his welfare and happiness, the

dissipation and the manipulation of energy. This activity also seems to be the function of every member of the starry hosts. And that "inspiring progressive principle for mankind to lay hold of for the satisfaction of that fundamental sentiment which aspires to a better condition" is the rightful manipulation of energy. This is the "law of brass" sought for by the modern sociologist.

Pope has to say concerning world relations in terms of units and limits the following beautiful but none the less truthful lines:

"Far as creation's ample range extends,
The scale of sensual mental powers ascends.
Mark how it mounts to man's imperial race
From the green myriads in the peopled grass.
What modes of sight betwixt each wide extreme.
The mole's dim curtain and the lynx's beam.
Of smell, the headlong lioness between,
And hound sagacious on the tainted green.
Of hearing, from the life that fills the flood
To that which warbles in the vernal wood.
The spider's touch how exquisitely fine,
Feels at each thread and lives along the line.
In the nice bee, what sense so subtly true
From poisonous herbs extracts the healing dew.
How instinct varies in the groveling swine.
Compare half reasoning elephant with thine.
'Twixt that and reason what a nice barrier,
For ever separate yet forever near.
Remembrance and reflection how allied!
What thin partitions sense from thought divide!
And middle natures how they long to join,
Yet never pass the insuperable line!
Without this just gradation, could they be
Subjected these to those or all to thee?
The powers of all subdued to thee alone,
Is not thy reason all their powers in one?
See through this air, this ocean and this earth,
All matter quick and bursting into birth.
Above, how high progressive life may go,—
Around, how wide, how deep extend below.
Vast chain of being: Which from God began,

Natures ethereal, human, angel, man,
Beast, bird, fish, insect, what no eye can see,
No glass can reach. From Infinite to thee,
From thee to nothing.
* * * *
All nature is but art unknown to thee,
All chance, direction which thou canst not see.
All discord, harmony not understood,
All partial evil, universal good.
And spite of pride or erring reason's spite,
One truth is clear, whatever is, is right."

In conclusion, the short duration of man in terrestrial form will not permit him to conceive of that grand scale of notions necessary to obtain an unchanging view of the world. To him it will ever be a relative term yet approximating nearer and nearer to the true conception as annals are collected, preserved and conceived. That there is progress cannot be gainsaid, providing progress in civilization means an advancement in the interpretations of world relations that man may better comply with the dictates of the cosmic principle. World relations as history presents them to the mind would indicate that man is ever adapting himself to satisfy them. Nations have risen, exerted their powers and have fallen to decay. New ones have taken their places, sometimes to advance along the line of progress, while others have fallen short of their predecessors. Such in the latter case have been the histories of those lands that once supported the Roman and Greek civilizations. Today these lands, by contrast, fall into places of mediocrity. England, Germany, France and the United States now furnish the standard for civilization. Not because they possess a better morality, religion or humanity pure and simple, but because they excel in manipulating energy. It is this and nothing

more. It may be a travesty on civilization to say that at present the most highly civilized people on earth are engaged in savage warfare while the savages themselves are at peace.

Now will this standard of civilization be advanced to a more perfected state? Has it arrived to perfection? When will decay begin? Will this western civilization perish from the earth? And will this subjective world again sink into a medieval sleep or another dark age? To the last question, the dictates of the cosmic principle with obedience thereto assure us with a hopeful negative. Nothing short of a universal catastrophe can now arrest the progress or expansion of the present system of civilization. Man is too powerful today to be lost on the face of the earth. He has discovered and claimed most all its parts. To converse around it is now a business. To encompass it is a pleasure.

Systematic study of the cosmic principle will point out the way for man to live and not retrograde. The knowledge of energy and its manipulation is the key to all advance in civilization and the possession of both is a guaranty for progress. The cardinal principles of the grand law are destined to become a universal creed. They will be adopted by man of every tongue and clime whether he will or no. Every Biblicist, Mohammed, Hindu, and Confucian, who advances in civilization, will recognize them as necessities for his earthly welfare and happiness. The cosmic principle is an universal one and is the central factor of all subjective reality. Fraternity and co-operation are a terse translation of its meaning to

man in the most realistic way. It was advocated by that guiding Spirit of humble men nineteen hundred years ago. The world had eyes but saw it not; had ears but heard it not; and had understandings but realized not the true meaning. World relations as an entirety were not capable of being known then. They were situated, as it were, far above the foot hills of common observation. The recorded experiences of man with the world and his interpretations thereof were not adequately gauged or co-ordinated. The instrument of thought for considering world relations as God would have us, the mathematical language, had not been sufficiently developed and mastered. This form of thought and Bacon's formula for applying it was the open sesame to the arcana of world relations known as modern science. This psychologic power alone distinguishes the thought of the occident from the orient, the modern from the ancient. It has been the cloud by day and the pillar of fire by night leading the western mind into conceptions of the absolute relations. It gave visions to Galileo while under the candlelabrum. It led him to peek at moons unknown and to time the turn of the sun. It gave to Newton the grand universal relation. It found faithful followers in Watt, Stephenson, Fulton and Ericsson; in Franklin, Henry, Farady, Bell and Edison; in Priestly, Lavoisier, Dalton and Darwin; in Helmholtz, Joule, LeSage, Thompson and Maxwell; in Descartes, Leibnitz, LaPlace and LaGrange; in Copernicus, Herschel, Kepler, Kant, Adams, LeVerrier and Clark and in unnumbered other gifted souls through whom the Spirit Eternal finds expression in cosmic tongue.

"Ye shall know the truth and the truth shall make you free" is a realization of the cosmic principle. Every human creature on the face of the earth shall manipulate energy and that abundantly. This is the divine requirement. Providence disposes in terms of energy manipulation. Perfect knowledge of the dictates of the cosmic principle is the happy wished-for dream of man, the meaning of the millennium.

"Go ye into all the world and preach the gospel to every creature" is being literally obeyed today. Faithful disciples follow the command implicitly and with the greatest of assiduity. They fashion self-binding harvesters to clasp the bountiful gifts of energy in cereal form in full-rounded, well-pressed weighty sheaves on the alluvial plains of India, Australia, Argentina, Siberia, Russia, Africa and America. They follow the brisk rustle of the sickle with the musical hum of the ingenious threshers, separating the golden grain from the chaff and the tares. They urge the strong and never tiring steed speeding as though with joy to bring these riches to the needs of men. They fetch glad tidings of these things with lightning's speed over land and under sea to devotees who needs must know that Nature's annual gifts are to be withheld or no. They tap the silent deep where gratuitous stores lie hid and bring them forth that man may welcome the winter's chilling blasts and be lighted on his way. McCormick, Case, Carnegie, Westinghouse, Armour, Scott, Rockefeller, Pullman, Vanderbilt, Gould, Morgan, Mackay, Whitney, Field and Washington as great captains, lead the hosts of humanity wielding the hammer, the throttle, the rudder, the shovel and the hoe. All are im-